For engineers who design and manage the power and plant services

Power

NOVEMBER 1959

ONE DOLLAR

A McGRAW-HILL PUBLICATION

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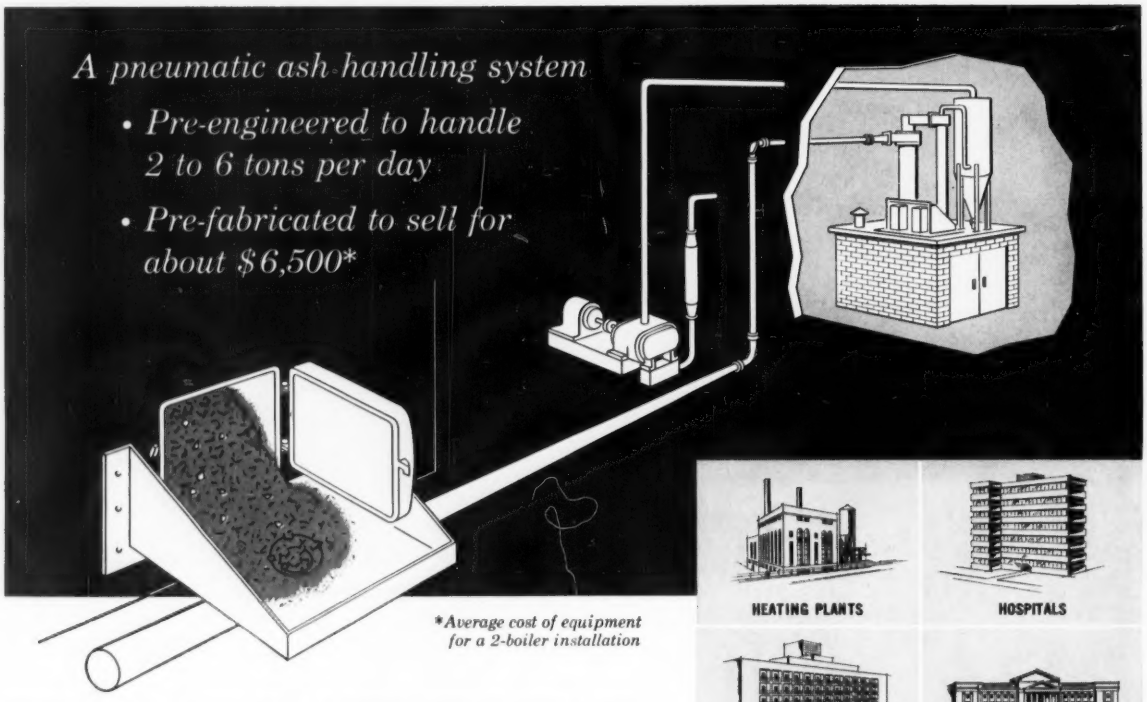
THE FIRST BIG BREAK IN ASH HANDLING COSTS
FOR THE SMALL COAL BURNING PLANT



*Average cost of equipment for a 2-boiler installation

Engineers of small coal burning plants—Heating Plants, Hospitals, Hotels, Institutional Buildings, Military Installations, Municipal Power Plants, Office Buildings, Schools, Colleges, Small Industrial Plants—have long wished for a small, practical ash handling system that would eliminate much of the inconvenience, dust and constantly increasing labor costs of manual ash removal. Available ash removal systems could not be economically justified where less than 10 tons of ash per day was produced.

Aware of this need, The Allen-Sherman-Hoff Company assigned its best engineering talent to untangle the problem. The result: the *new* A-S-H Econo-Ash System.

A major step in solving this problem was pre-engineering. Use-proved designs of major components were re-engineered to handle smaller quantities; new equipment was designed and tested. One requirement was basic: cost reduction without loss of efficiency. Installation, for example, was made so simple that it can be made with local labor.

We've prepared a 4-page brochure to explain the *new* Econo-Ash System—how it operates, its variations and its advantages. We'll send it to you immediately upon request. It also lists the A-S-H Sales Engineers—one is near you—who will be glad to show you how, in most installations, the *Econo-Ash will pay for itself in two years or less.*

MATERIALS HANDLING SYSTEMS

"Hydrojet" *hydraulic*

"Hydrovac" *pneumatic*

the **Allen-Sherman-Hoff** company

259 E. Lancaster Ave., Wynnewood, Pa.

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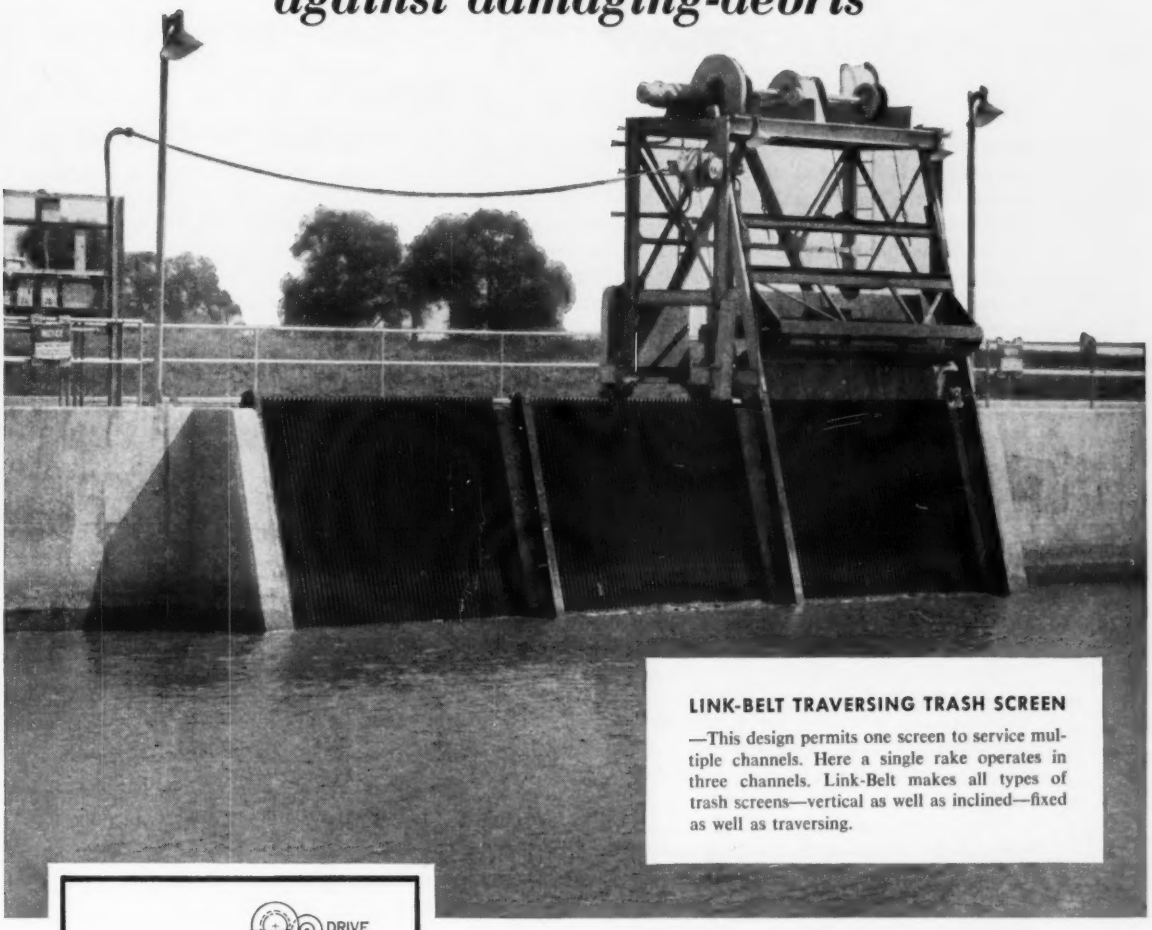
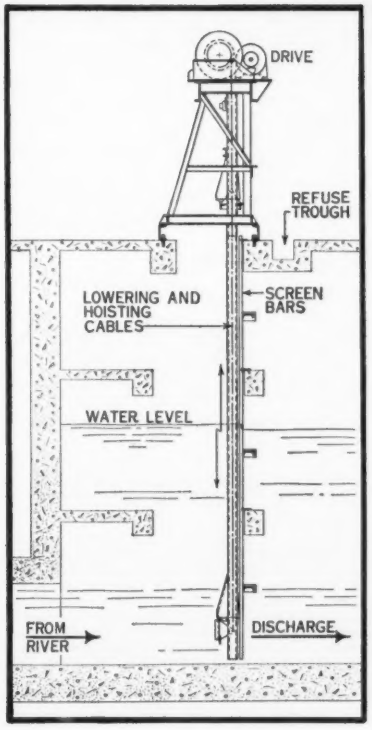
ESSENTIAL SAFEGUARD
against damaging-debris



LINK-BELT TRAVERSING TRASH SCREEN

—This design permits one screen to service multiple channels. Here a single rake operates in three channels. Link-Belt makes all types of trash screens—vertical as well as inclined—fixed as well as traversing.



LINK-BELT trash screens provide economical, effective protection for pumps, turbines and screens.

Put a protective screen between vital equipment and destructive debris such as logs and ice. Link-Belt trash screens also reduce load on traveling water screens during heavy seasonal accumulations of leaves, Spanish moss, water hyacinths and algae.

These screens feature simple design, rugged construction. They require little attention—operation is necessary only when trash has accumulated. This is accomplished by merely pressing a button to actuate the motor-propelled rake. Refuse is then removed manually from the rake to a refuse trough. Intermittent operation keeps power costs down to a minimum.

And Link-Belt will work with your engineers and consultants in supplying whatever your plant requires in screening, coal handling and mechanical power transmission equipment. Get complete facts from your nearest Link-Belt office. Or write for Book 2587.

LINK-BELT

15,184

POWER PLANT EQUIPMENT

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For more facts circle 204 on Reader Service card, p 101

speaking of **Power**

Renewed interest in use of direct current throughout industry is evident all around us. This is a sharp reversal of the trend established a few decades ago. Why? Simply because industry is finding more need for variable-speed and electrochemical operations requiring dc. Inherent variable-speed and torque characteristics of the dc motor cannot be matched with ac equipment.

Use of dc has always presented problems where the generating source is ac. A rectifier must be installed and maintained in addition to the dc motor and starter. These are but a few of the reasons engineers steer clear of dc unless there is no practical way of doing the job with ac. But in recent years significant developments have been made in both rectifiers and dc motors, making the whole dc package more attractive.

A survey by McGraw-Hill's Research Dept among POWER readers in manufacturing and service industries showed the expenditure for ac-to-dc conversion equipment in subscriber plants exceeded $30 million in 1957. This included mercury-arc rectifiers, m-g sets and the semiconductors. The total market for electrical products in POWER-subscriber plants (manufacturing and service industries only) totaled almost $500 million. With recent technical advances made with the semiconductors, particularly silicon, we can expect more growth.

You will find a 24-page special report in next month's issue giving perspective to the complete electrical-conversion picture. This report, by Associate Editor Norm Peach, will cover today's practice in rectifying ac to dc and in converting 60-cycle to a higher frequency. Marked changes in the area of static conversion equipment make this report *must* reading for every engineer concerned with electrical power service. Watch for it!

Lon Rowley

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A Compact, Space-Saving Package of Efficient Grinding Power

Exceptional output and efficiency records . . . highlighted by low maintenance . . . have been established in hundreds of installations by B&W Pulverizers. Their long-range dependability has been accompanied by reduced operating costs.

Simplicity of Arrangement and Reduced Maintenance: Accessibility for all normal maintenance makes it simple, quick, safe, and low-cost. Adjustments are easily made while the unit is in operation. Using only clean primary air supplied under pressure, fan maintenance is substantially reduced and fuel piping is greatly simplified. Also, with the pulverizer acting as its own distributor, no special distributing devices are needed. Grinding elements are of special alloy material. They last two years or more on eastern coals and at least a year on midwestern coals.

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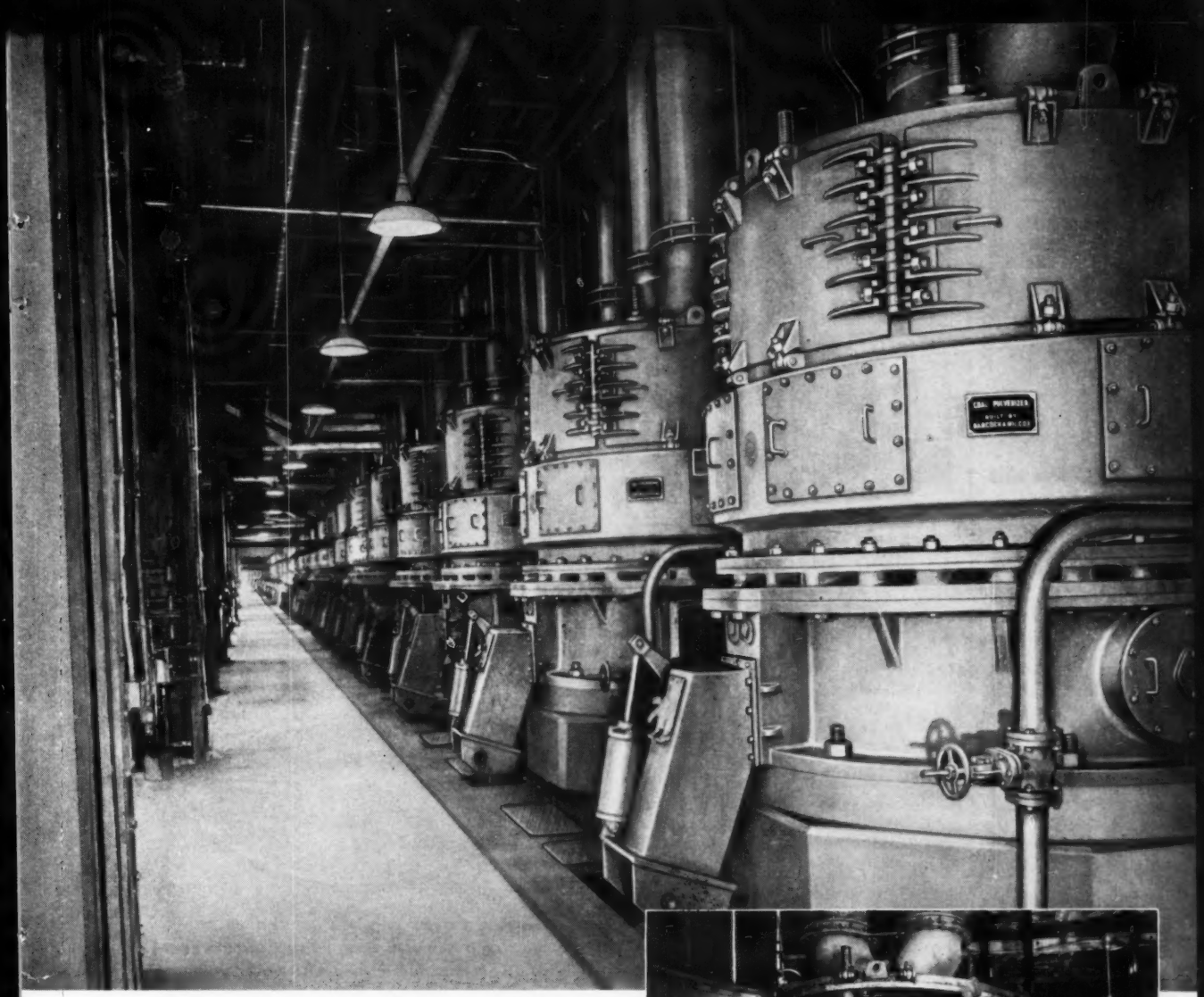
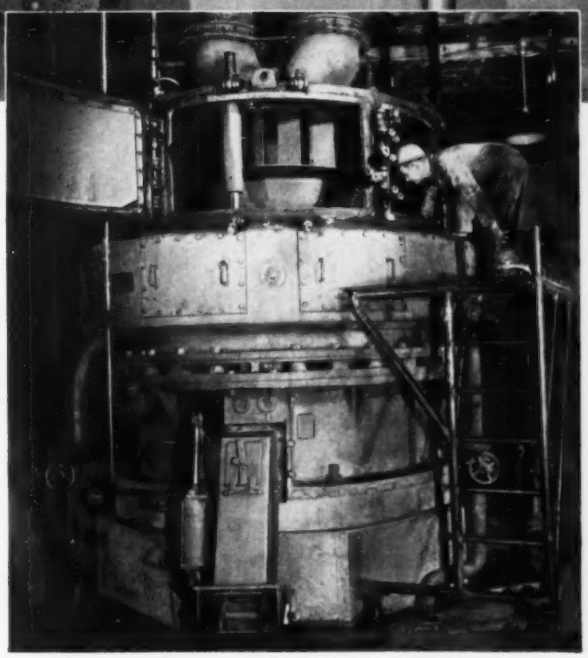
Adaptable to All Types of Automatic Controls: Because it features "one point contact with the





(Above) Part of the 42 B&W Pulverizers serving six B&W Open-Pass Boilers. (Right) Maintenance is simple: doors open wide, classifier and spring assemblies are readily accessible for removal. Grinding components are lifted without special rigging.

boiler," operation of the B&W Pulverizer is simple. The boiler's automatic combustion control is connected to the pulverizer at only one point—the damper in the primary-air duct. The pulverizer's own control system regulates all other functions, such as maintenance of proper fuel-air ratio and operating temperature.

SEND FOR DATA. For full information about the B&W Pulverizer and Pulverized-Fuel Firing Systems, write: The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

B&W

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BOILER DIVISION

G-924

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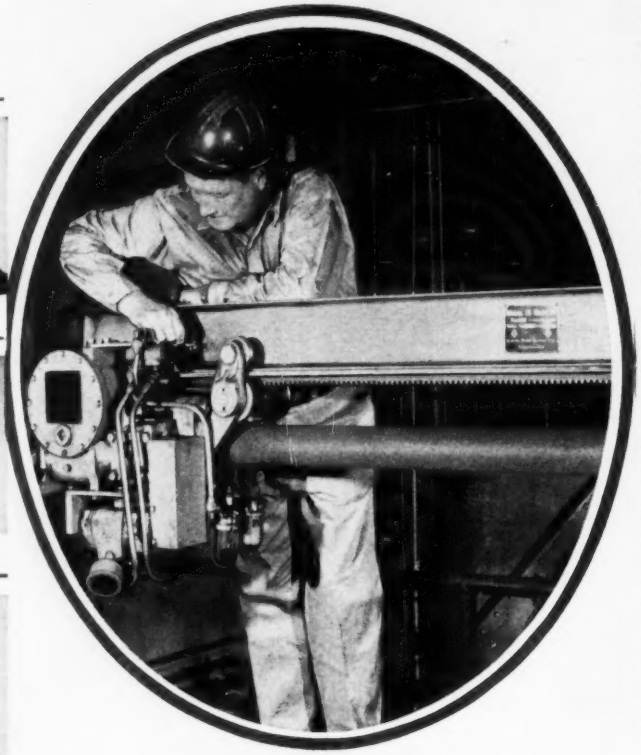

Diamond Service Specialist making an adjustment on a Model IK Long Retracting Blower to assure maximum cleaning efficiency. Diamond Service is effective preventive maintenance.

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A unique field service dedicated to giving you

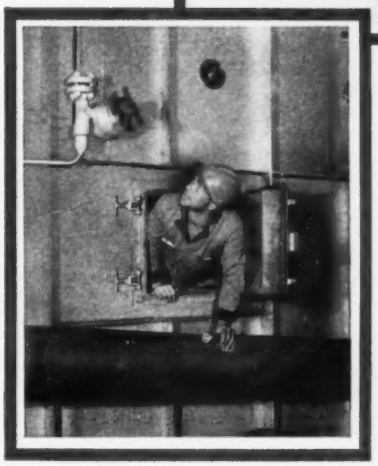
Better Boiler Cleaning At Lower Cost

The principal duty of these 31 full time, factory trained field service specialists is to insure that Diamond Blowers operate correctly to give you the best boiler cleaning possible and at minimum cost. They are cleaning experts who inspect and adjust Diamond Blowers in stationary (and marine) water tube boilers. This inspection service is rendered regularly . . . unsolicited and without charge.

There is nothing else quite like it in the power industry, and it saves the user of Diamond Blowers money two ways: First, these men often are able to detect potential trouble before it becomes serious or costly . . . preventive maintenance that keeps repair costs down. Second, by seeing that blowers are in good repair and adjustment . . . instructing operators in correct operation and care . . . and by recommending the most efficient and economical blowing schedules, they assure cleaner boilers at lower cost. Boiler efficiency is maintained . . . blowing costs kept down.

This is one of many important plus values you get with Diamond Blowers and Blower Systems.

Diamond Service Specialist showing operator how his flue gas temperature drops when he uses his blowers correctly and regularly.



Diamond Service Specialist makes internal inspection to check cleaning effectiveness of the blowers.

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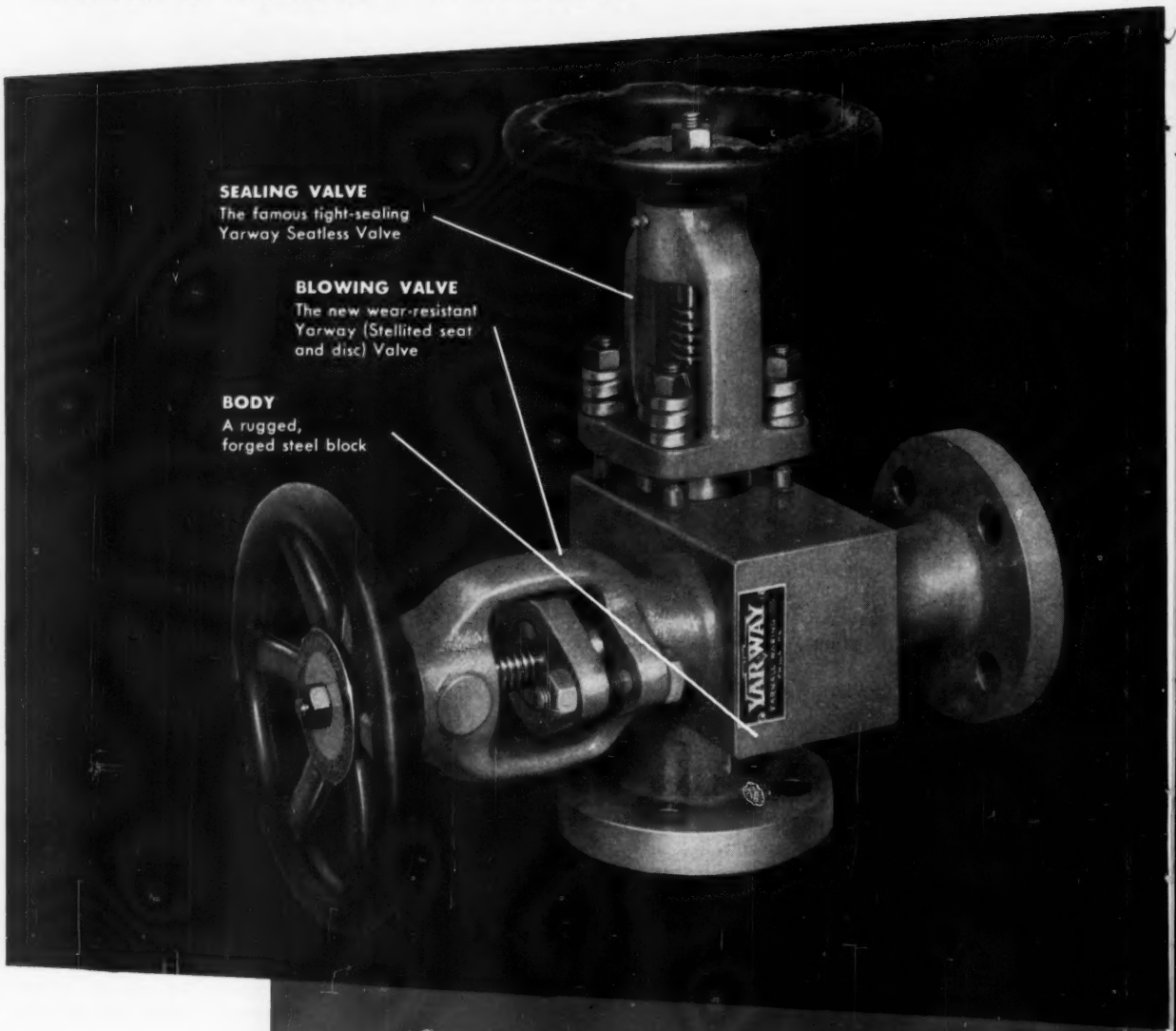
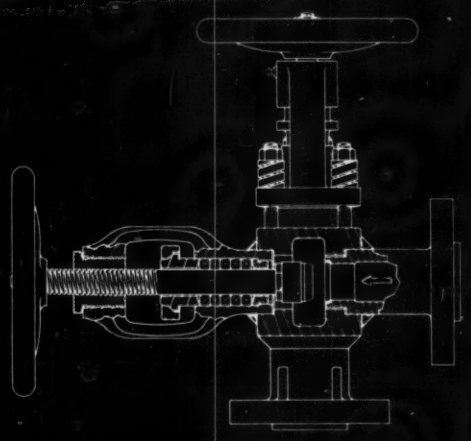
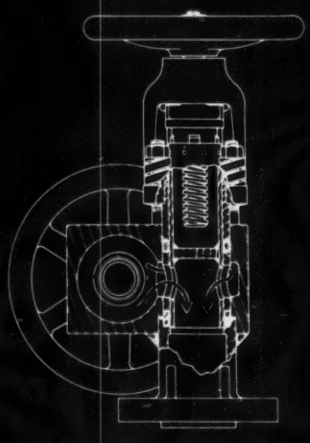


NOW! A NEW YARWAY BLOW-OFF VALVE FOR



Cross-section of medium pressure Unit Tandem Valve showing hard-seat blowing valve in open position.



Cross-section showing seatless sealing valve in open position. Flanged ends shown, welding ends also available.

UNIT TANDEM MEDIUM PRESSURE BOILERS

There's a new star in the Yarway Blow-Off Valve line.

For years rugged Yarway Unit Tandem Blow-Off Valves have been standard equipment on most high pressure boilers. In fact, more than 80% of high pressure plants use Yarways.

Now a *new design* Unit Tandem is offered for *medium pressure boilers to 665 WSP.* Streamlined, lighter in weight, easy to operate, tight sealing and long wearing —this valve brings premium quality Yarway Unit Tandem dependability to the medium pressure field— *at a competitive price!*

Important features, like the nitralloy plunger in the sealing valve and integral stellite seat and disc in the blowing valve, make this your best buy for blow-off service.

Order Yarway Unit Tandems for your present boilers— or specify them on new boilers.

For full details write for Yarway Bulletin B-435, Supplement A.

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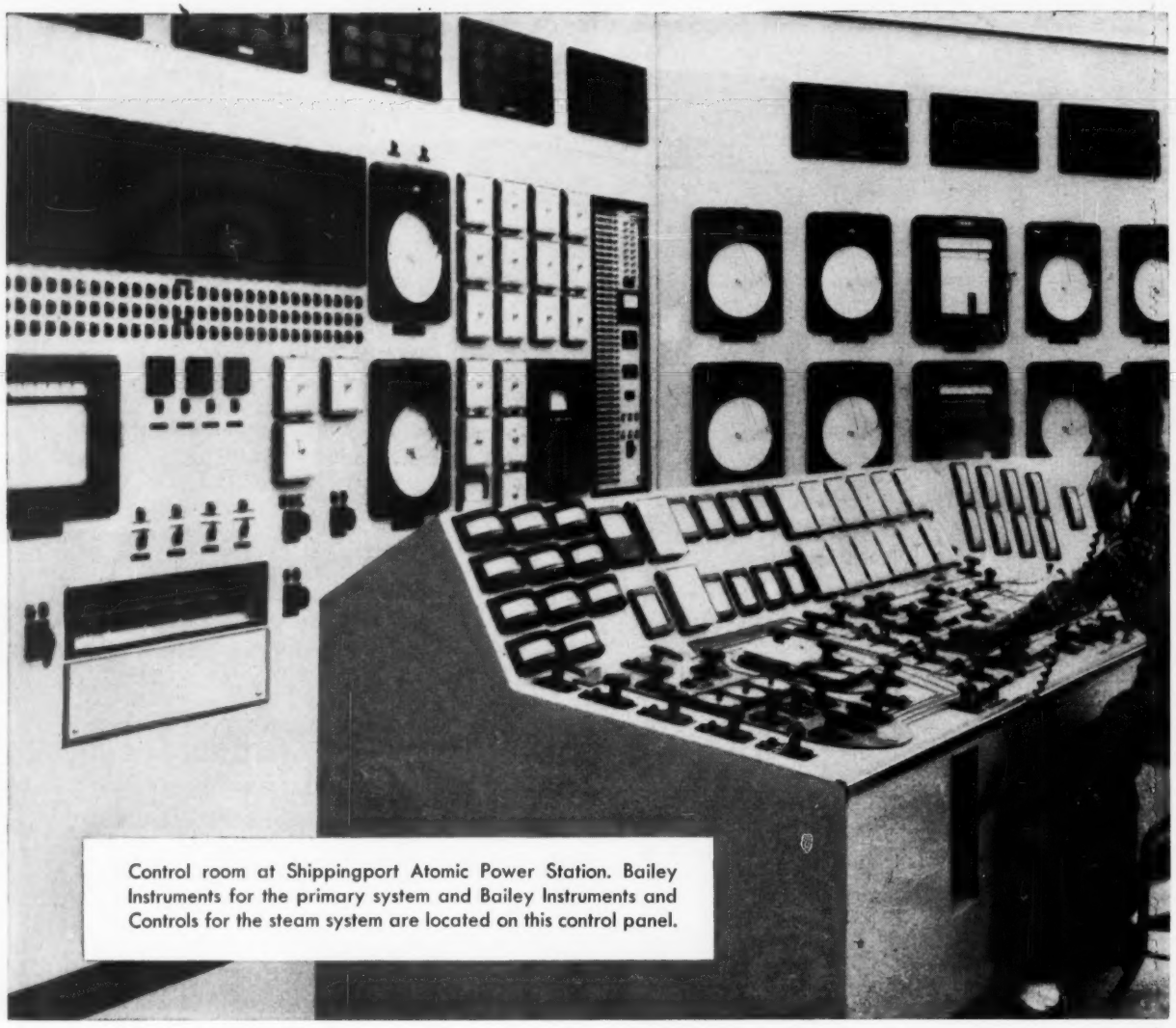


Control room at Shippingport Atomic Power Station. Bailey Instruments for the primary system and Bailey Instruments and Controls for the steam system are located on this control panel.

Bailey pioneers the control of...

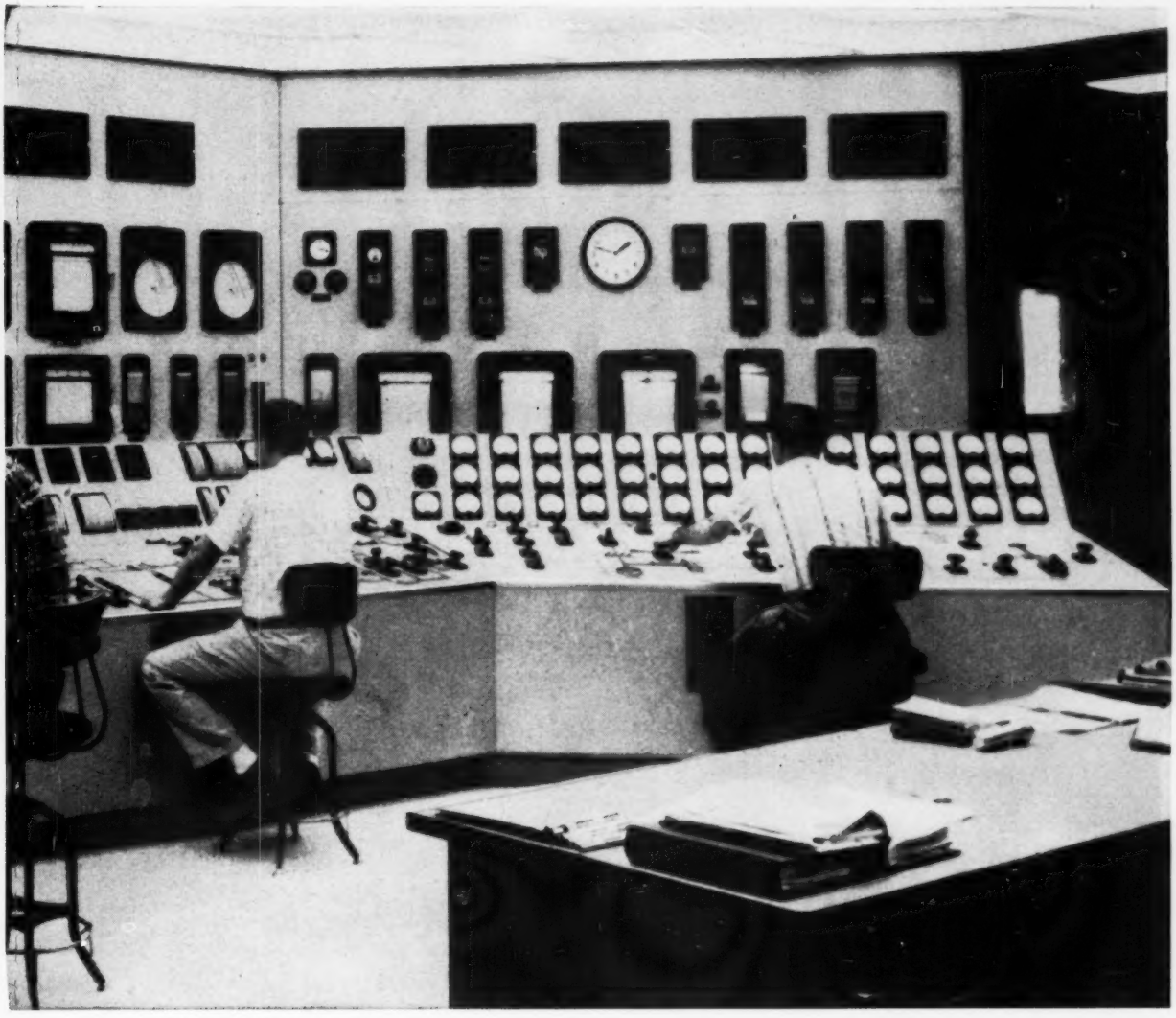
This control room is the center of operations for the world's first full-scale atomic, electric power plant devoted exclusively to civilian use—the Shippingport Station, jointly owned by Duquesne Light Company and the Atomic Energy Commission.

Here, as well as on the atomic-powered submarines, are Bailey Instruments and Controls performing dependably hour after hour, month after month.

In conventional power plants, too, Bailey Meters and Controls are standard equipment. Bailey is the choice of virtually all the most efficient plants on the Federal Power Commission's heat rate report. Here's why:

1. A Complete Line of Equipment

You can be sure a Bailey Engineer will offer the right combination of equipment to fit your needs. Bailey manufactures a complete line of standard compatible pneumatic and electric metering and control equipment that has proved itself. Thousands of successful installations involving problems in measurement, combustion and automatic control are your assurance of the best possible system.



ATOMIC STEAM POWER PLANTS

2. Experience

Bailey engineers have been making steam plants work efficiently for more than forty years. Veteran engineer and young engineer alike, the men who represent Bailey, are storehouses of knowledge on measurement and control. They are up-to-the-minute on the latest developments that can be applied to your problem.

3. Sales and Service Convenient to You

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A136-2

Instruments and controls for power and process

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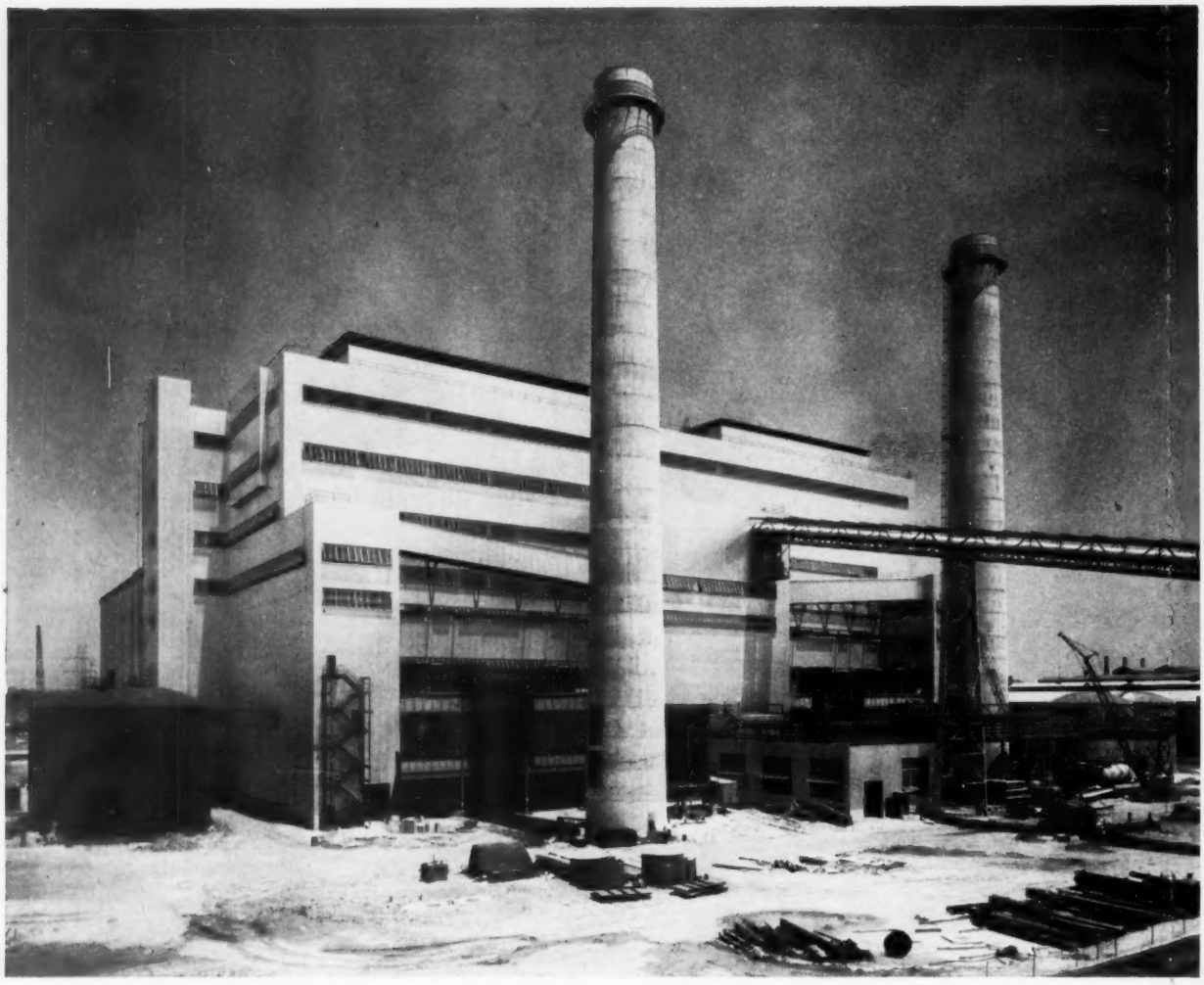


Eddystone Station's Unit 1 has a capacity of 2,000,000 lb/hr at 5000 psig and 1200°/1050°/1050°/F . . . uses C-E Sulzer Monotube Steam Generator.

Vulcan Selective-Sequence system provides Eddystone Station with precision soot blowing

When Unit 1 of Philadelphia Electric's Eddystone Station goes into operation, a Vulcan Selective-Sequence system will accurately control all soot blowing.

Selective-Sequence systems were chosen for both units 1 and 2 at this super-critical station because they assure positive, dependable boiler cleaning . . . make the most efficient use of the blowing medium.

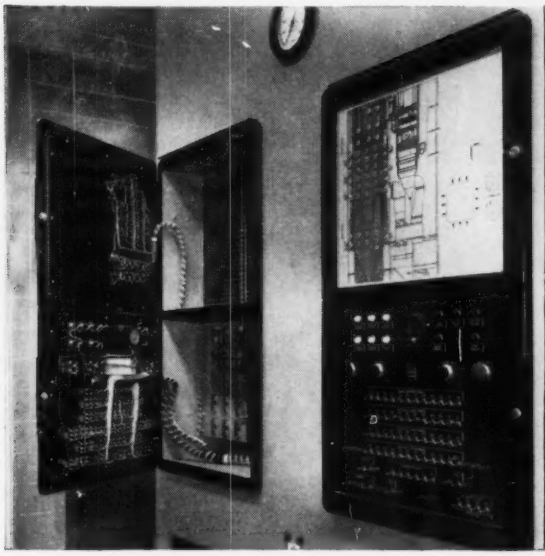
Vulcan Controller saves time. Without leaving the panel, the operator pushes a master button to place the system in sequential operation. He can see that each soot blower is operating in sequence for the proper interval with adequate pressure. He can modify the sequence to improve cleaning or conserve the blowing medium without time-consuming wiring and piping changes.

Vulcan long retractables speed cleaning. With dual-motor drive, Eddystone's T-30's clean uniformly; minimize the danger of tube cutting or erosion. Low rotating speed increases range and penetration of cleaning, decreases wear, eliminates whip, and permits proper cleaning with faster traversing speeds.

Half-'tracts with 19-foot travel, wall deslaggers, and air pre-heater controls are also used.

COPES-VULCAN DIVISION
BLAW-KNOX COMPANY, ERIE 4, PA.

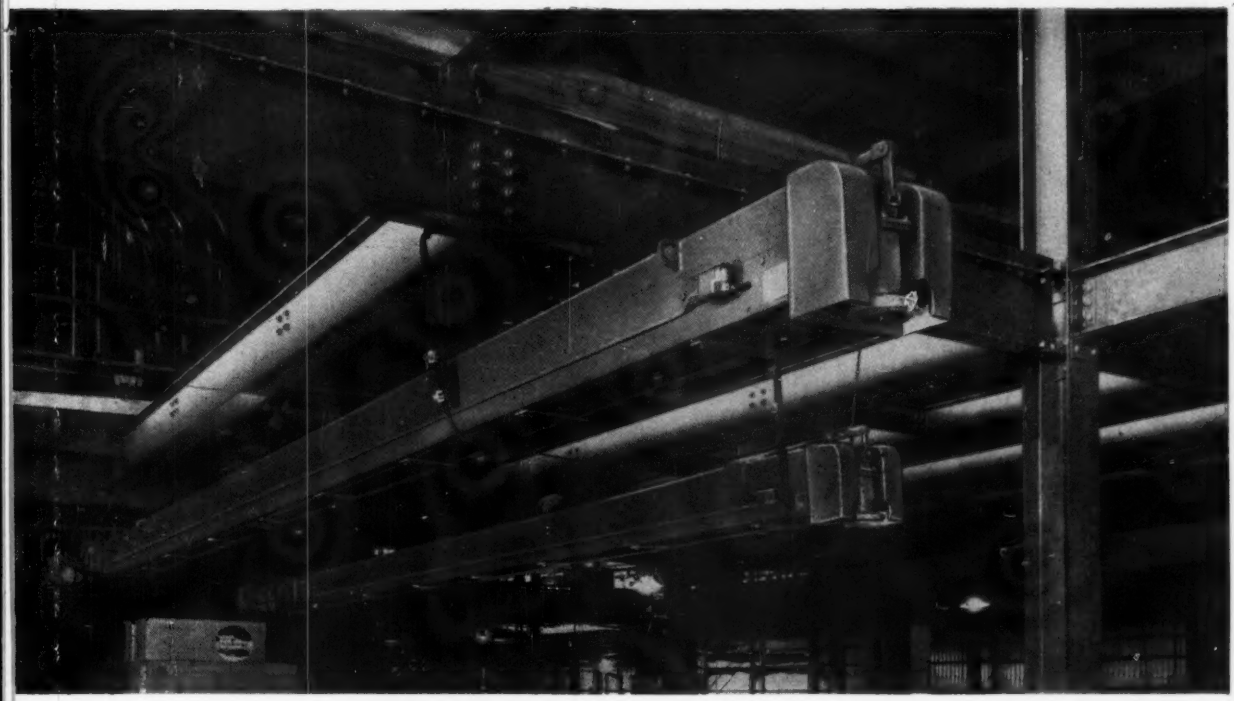
BLAW-KNOX



Panel provides centralized control of soot blowing at Eddystone. With the Vulcan SSC-120 Selective-Sequence controller, each blower can be operated four times during a schedule, or there can be four different schedules. The sequence can be varied by means of a jack board. Any soot blower can be operated at any point in the sequence by plugging one end of a patch cord into the blower jack, and the other end into the desired sequence jack. Write for Bulletin 1029.

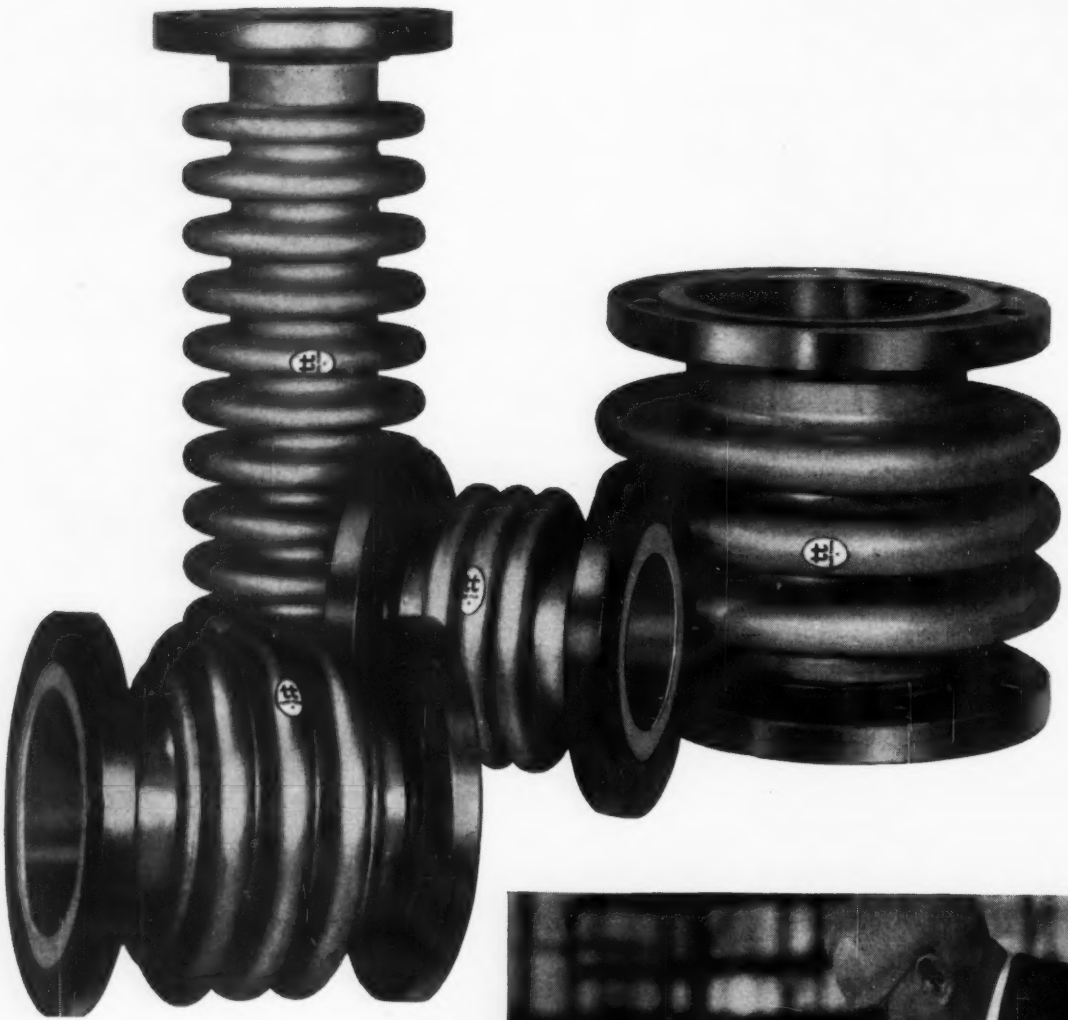
Wall deslagger conserves steam generated at Eddystone by three special package boilers. High striking power of Vulcan RW-3E drives off gummy masses to assure high heat-transfer capacity, and uniform superheat and reheat temperature control. Dual motors are used: one speeds the nozzle to and from the blowing position, the other rotates it slowly for thorough cleaning. All parts are covered for protection, assuring long life with low maintenance. Write for Bulletin 1034.

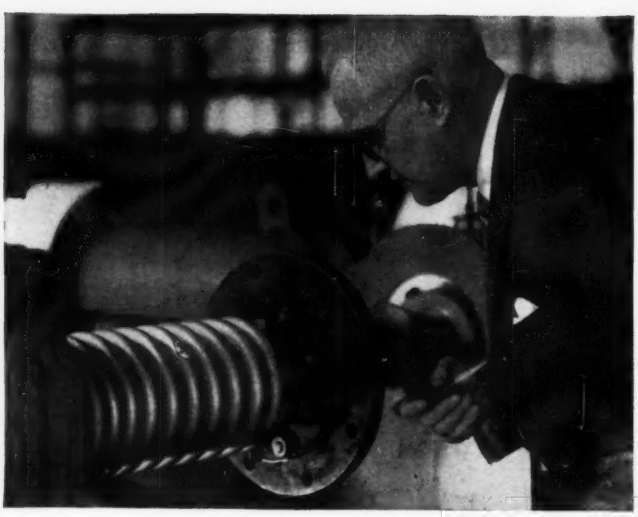
Vulcan T-30's have 30- and 37-foot travels. Motors are mounted at the boiler end to facilitate maintenance, yet away from heat of the boiler wall. Their placement avoids interferences. Write for Bulletin 1030.



For more facts circle 209 on Reader Service card, p 101

NEW...FROM





TUBE-TURN *Bellows Expansion Joints are test rated on basis of minimum cyclic life.*

TUBE TURNS...

Bellows Expansion Joints test rated for assured cyclic life

Tube Turns has introduced a brand new concept in bellows expansion joints to fill a vital need in engineered piping systems.

These new bellows joints are rated on the basis of thorough, well organized test studies to *assure a definite minimum cyclic life*... rather than the usual average or maximum. This conservative rating, backed by Tube Turns' extensive test results, gives you an assurance of *confidence* heretofore lacking in the application of bellows joints.

Hence, you can specify TUBE-TURN* Bellows Expansion Joints and be sure of predictable performance. These top-quality products will be subject to the same warranties that apply to all other products of Tube Turns.

Backed by Tube Turns' technical service! This new line of products is backed by 31 years of pioneering research in piping technology, including problems of piping flexibility. Our sales-engineering staff, located nearby, will assist in the application of TUBE-TURN Bellows Expansion Joints to your specific problems.

Available from your nearby Tube Turns' Distributor. You can order TUBE-TURN Bellows Expansion Joints along with fittings and flanges from your complete-line Tube Turns' Distributor. Here is still another *plus value* you get when you specify and buy TUBE-TURN products.

*The trademarks "TUBE-TURN" and "tt" are applicable only to the quality products of Tube Turns.

Another tt *plus value from...*

TUBE TURNS

DIVISION OF CHEMETRON CORPORATION
Louisville 1, Kentucky

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DISTRICT OFFICES: Atlanta • Chicago • Columbus • Dallas • Denver • Detroit
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MAIL FOR CATALOG. Lists available sizes of TUBE-TURN Bellows Expansion Joints... includes rating tables to guide in piping design. Mail coupon for free copy.

TUBE TURNS, Dept. PM-11
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Send catalog on TUBE-TURN Bellows Expansion Joints.

Company Name _____

Company Address _____

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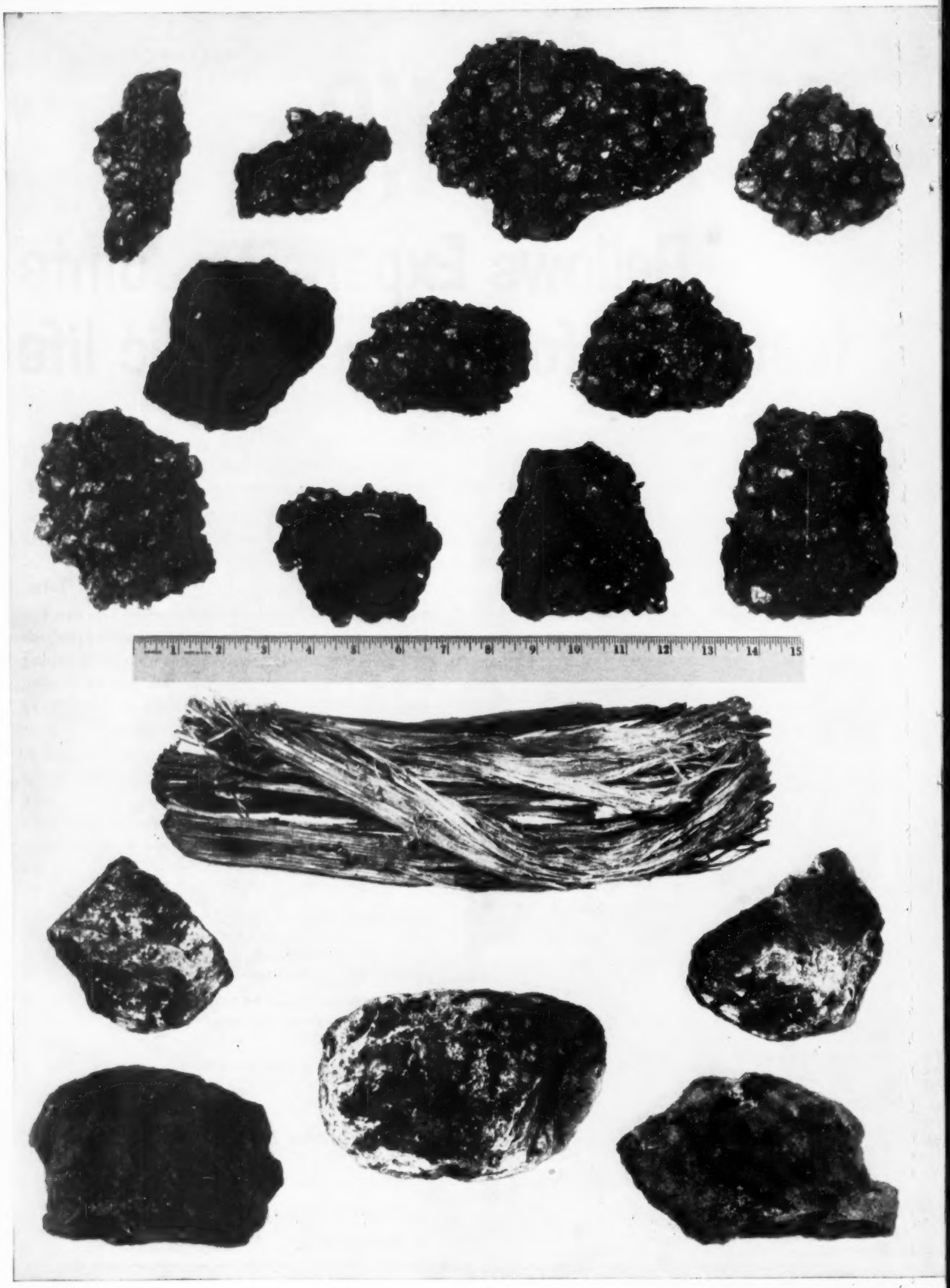
Your Name _____

Position _____



Once in a while...

something big comes along. Maybe it's a piece of wood or ball of pyrites or a chunk of frozen coal. Even in the best managed plants it happens occasionally. When it does, you have a right to expect the feeders to your pulverizers or cyclone burners not to plug or jam.

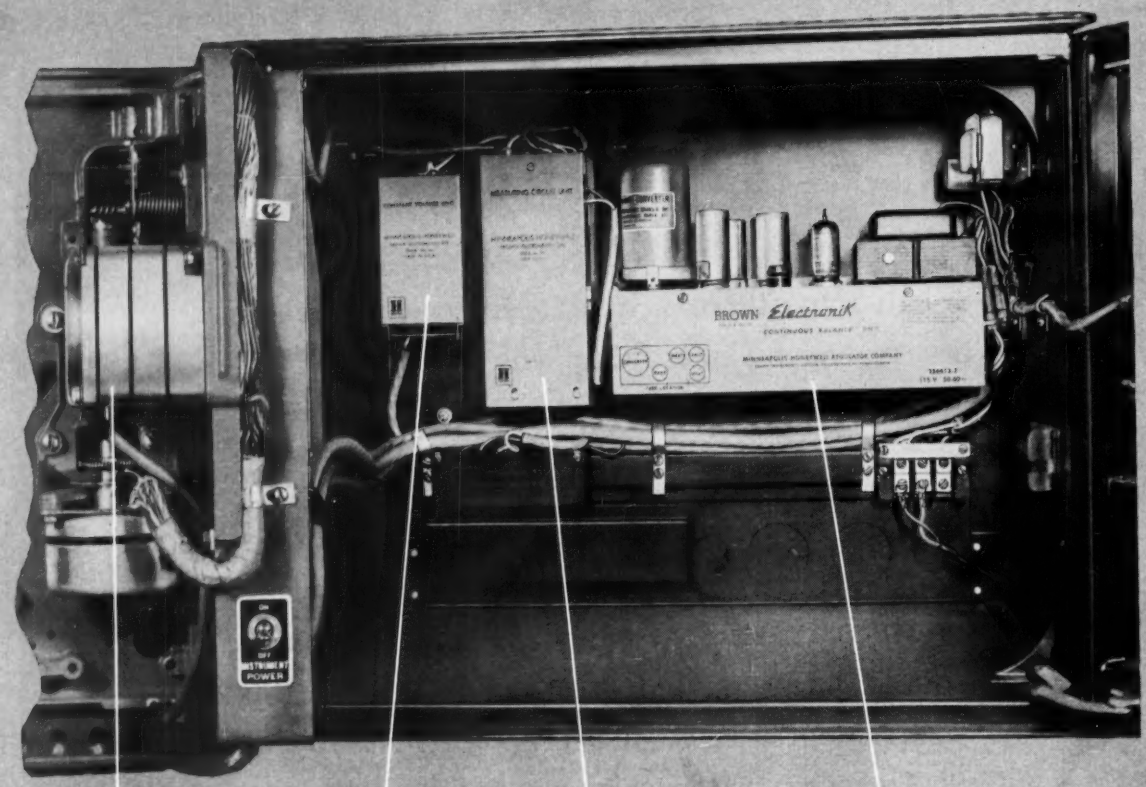
S-E-Co. *Volumetric Feeders* and S-E-Co. *Gravimetric Feeders* are built to assure reliable operation no matter what comes along. The full 24" width of coal stream from inlet through to outlet and the fact that the coal is carried on a heavy duty belt contribute to this ability. The samples of frozen coal, wood, and pyrites you see on the opposite page are just a some of the oversized objects that have come through S-E-Co. feeders without interrupting the flow of coal.

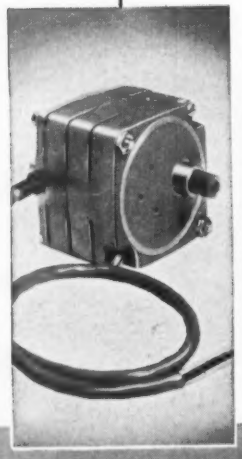
Of course you don't want to feed your pulverizers or cyclones a steady diet of wood and pyrites. What you do want is a steady, well controlled flow of coal. Even fine, wet, sticky coal is duck soup for S-E-Co. feeders.

In your next boiler specification include
S-E-Co. Volumetric or Gravimetric Feeders

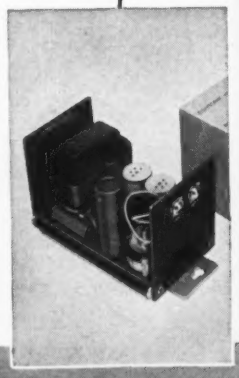
Write for bulletins.

STOCK Equipment Company
725 HANNA BUILDING • CLEVELAND 15, OHIO

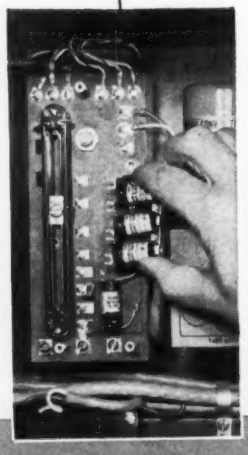




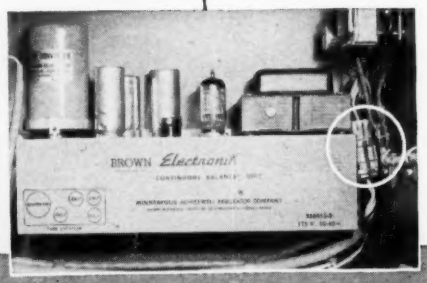
Servo Motor has sectional housing, leakproof oil wick, printed circuits for simplified servicing. Any major part can be replaced in 2 minutes.



Constant Voltage Module—Uses Zener diodes and an ambient temperature compensator to replace standardizing mechanism.



Measuring Circuit Module—Contains easily-changed range spool panels and vernier adjustment. Range is changed simply by replacing screw-clip panels of fixed resistors.



Amplifier Module—Quick-connect design permits fast, easy removal for servicing and replacement. Circle shows quick connect plug.

THESE FOUR NEW FEATURES ARE STANDARD WITH ALL *ElectroniK* POTENTIOMETERS

New modular design...

makes *ElectroniK* potentiometers easier to use and maintain

Now, four great new features add new operating and servicing ease to all *ElectroniK* circular and strip chart potentiometers.

- **New servo and chart drive motors are sectionalized so that any major part can be replaced in two minutes.**
- **A new constant voltage unit replaces batteries, standard cells and standardizing mechanisms.**
- **A new measuring circuit, with quick-change range spools, simplifies range changing and reduces stray pickup.**
- **A quick-connect feature lets you remove the amplifier for service and replace it quickly.**

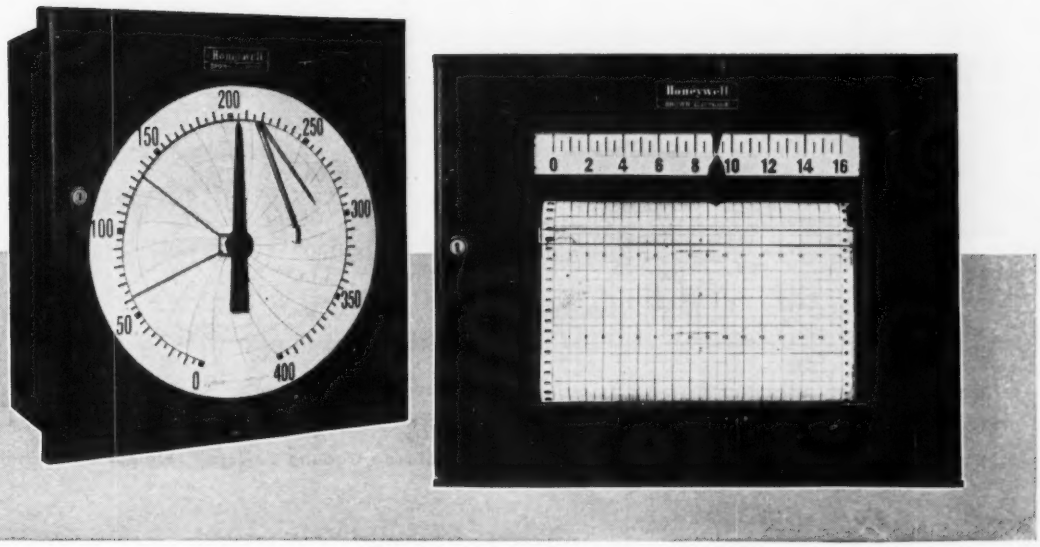
Now, modular design is combined with the traditional precision of *ElectroniK* potentiometers, to give you a greater value than ever in accurate, dependable measurement and control.

For full details, call your nearby Honeywell field engineer today. He's as near as your phone.

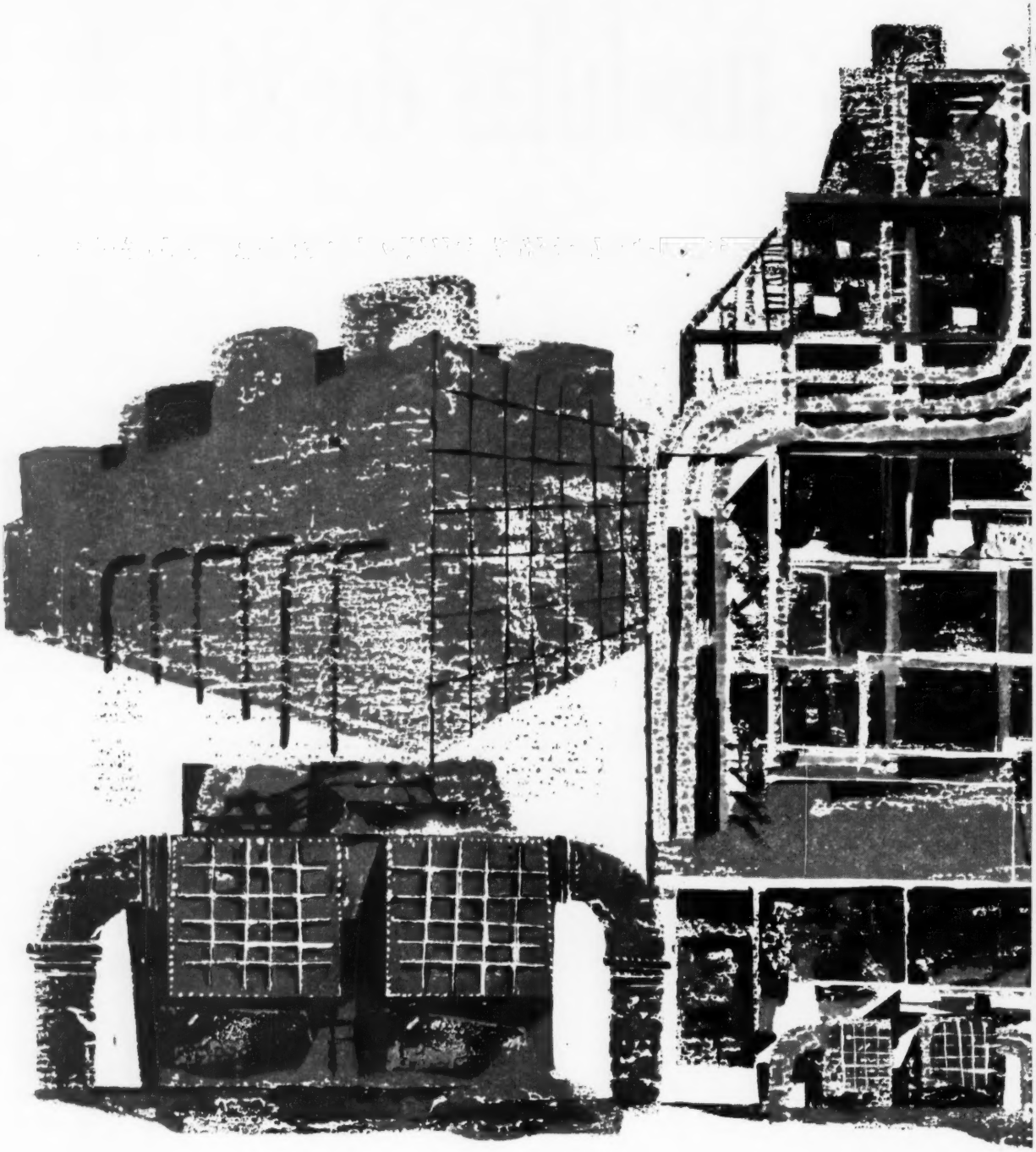
MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

H HONEYWELL *First in Control*

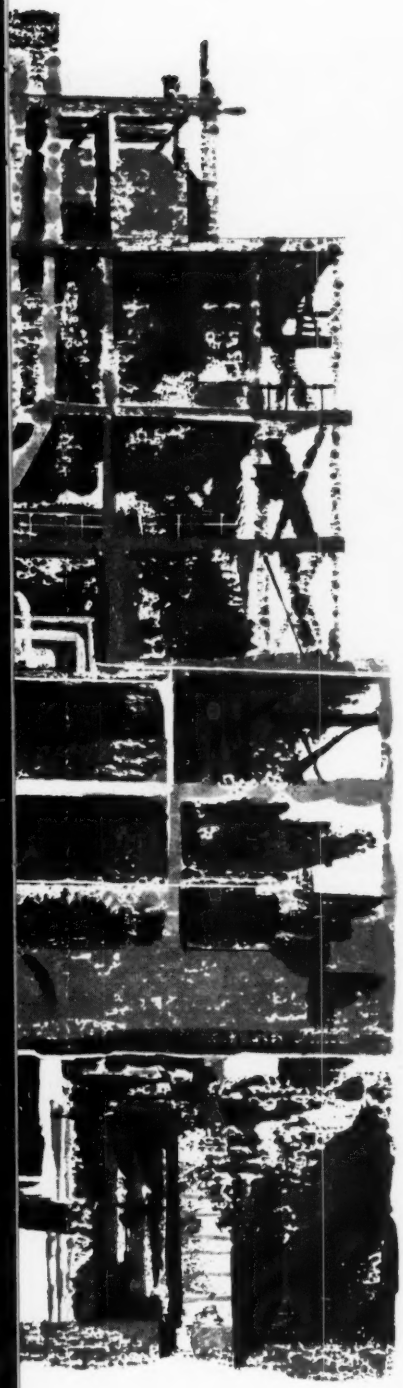


For more facts circle 212 on Reader Service card, p 101



POWER PLANT PRODUCTS HEAT ENGINEERED BY FOSTER WHEELER:

Central Station and Industrial Steam Generators • Steam Condensers and Pumps • Pulverized Fuel Systems • Feedwater Heaters • Packaged Steam Generators • Cooling Towers • Nuclear Components



The one kind of engineering every plant needs

You may use heat to produce steam, electricity, or chemical reactions—but if you use it for any industrial purpose at all, heat is probably one of your major items of operating expense. There's also a good chance that heat is costing you more than it should.

That's because every piece of equipment that uses heat—be it a steam generator, heat exchanger, or simply piping—is a potential weak spot in your budget unless it is engineered to get the *optimum* out of the heat-dollars you put into it. At Foster Wheeler, getting the *most* out of heat is expressed as *Heat Engineering.*

Heat Engineering is the reason you'll see FW-built equipment in such critical places as nuclear power stations, on the world's largest and most efficient tankers and naval ships, in giant steam-electric plants, and refineries and chemical process plants of all types and sizes.

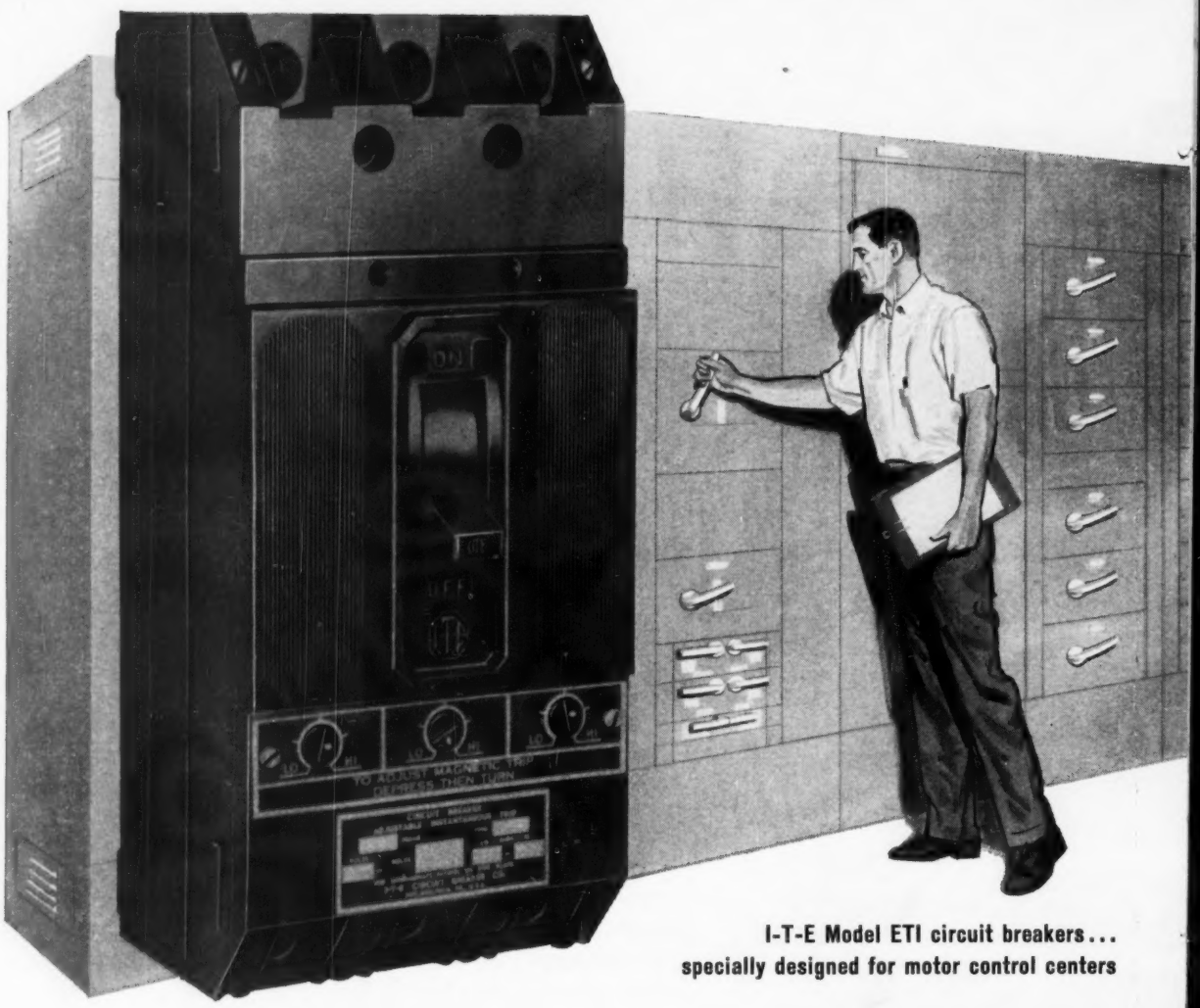
If your company is contemplating *any* modernization, expansion, or replacement where heat is concerned, why not check into the difference *Heat Engineering* can make? Contact Foster Wheeler Corporation, 666 Fifth Avenue, New York 19, N. Y.

Heat Engineered products, plants and processes ... for the world's industrial progress.

FOSTER WHEELER

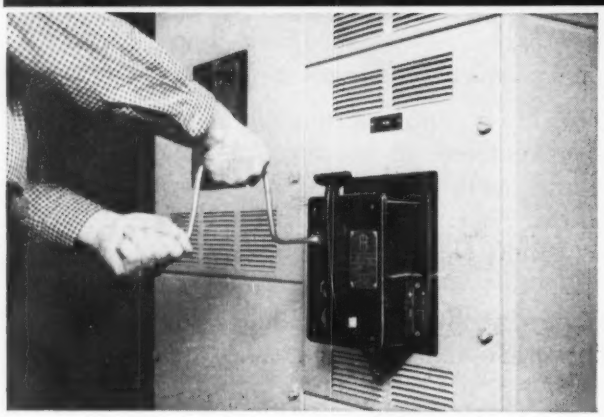
NEW YORK LONDON PARIS ST. CATHARINES, ONT.

For more facts circle 213 on Reader Service card, p 101



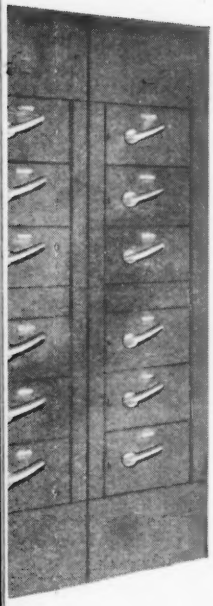
I-T-E Model ETI circuit breakers...
specially designed for motor control centers

GET THE EXTRA ADVANTAGES OF THESE OTHER



Most advanced 600 v power switchgear . . . with new I-T-E K-LINE circuit breakers. Pulldown handle and stored energy mechanism give 5-cycle closure every time. Means longer contact life, greater operator safety, less maintenance. Wide load range trip adjustment saves later modification. Closed door disconnect for safety.

Best coordinated secondary unit substations. Only I-T-E designs and builds complete secondary unit substations in one plant. Engineers work closely together. So you benefit from extra time and money-saving features: better coordinated designs, easier assembly, pretested performance, and delivery to match your own construction schedule.



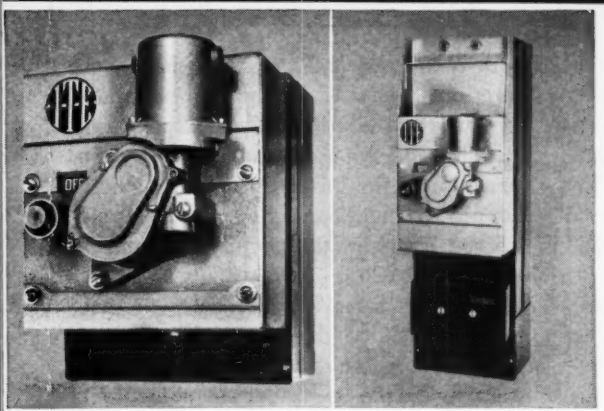
Motor circuits need this PINPOINT PROTECTION

I-T-E Model ETI circuit breakers are special purpose . . . with advantages that motor circuits need for complete protection. Unlike regular circuit breakers, they can be easily set to an instantaneous rating about 11 times normal full load current. This gives instant protection against overload damage without nuisance tripping. Regular breakers are preset at instantaneous ratings as high as 100 times full load current.

Look what this difference means. Take the example of a 20 amp breaker recommended for use with a motor starter for a 500 horsepower 440 volt a-c motor. Full load current is 7.5 amp. An ordinary breaker would have an instantaneous trip setting of 500 amp—many times the desired value. A high resistance fault or short circuit current less than 500 amp could do permanent damage before thermal devices would trip the breaker. But a 25 amp Model ETI breaker in this application would have an instantaneous trip setting of only 87 amp . . . giving instant opening in case of high current faults without nuisance tripping. Model ETI circuit breakers are available in five frame sizes and in ratings up to 800 amp continuous.

I-T-E CIRCUIT BREAKER COMPANY

I-T-E PRODUCTS TOO



TELEMAND* . . . Molded case economy . . . remote control luxury. Now I-T-E molded case circuit breakers are available with new motor operators for remote opening, closing or resetting. Can be easily wired for pushbutton control from a distance. Costs far less than alternative devices. Also permits local or automatic operation.

I-T-E Circuit Breaker Company I-4
1900 Hamilton St., Philadelphia 30, Pa.

- ☐ Molded case circuit breakers for motor control centers
- ☐ K-LINE LV switchgear (600 v)
- ☐ Secondary unit substations
- ☐ TRANFO-UNITS†
- ☐ TELEMAND motor-operated molded case breakers
- ☐ Power switching centers
- ☐ URELITE® circuit breakers
- ☐ Metal-clad switchgear (4.16 and 13.8 kv)

†*Tranfo-Unit is a Reg. TM of I-T-E*

Name_____ Title_____

Company_____

Street_____

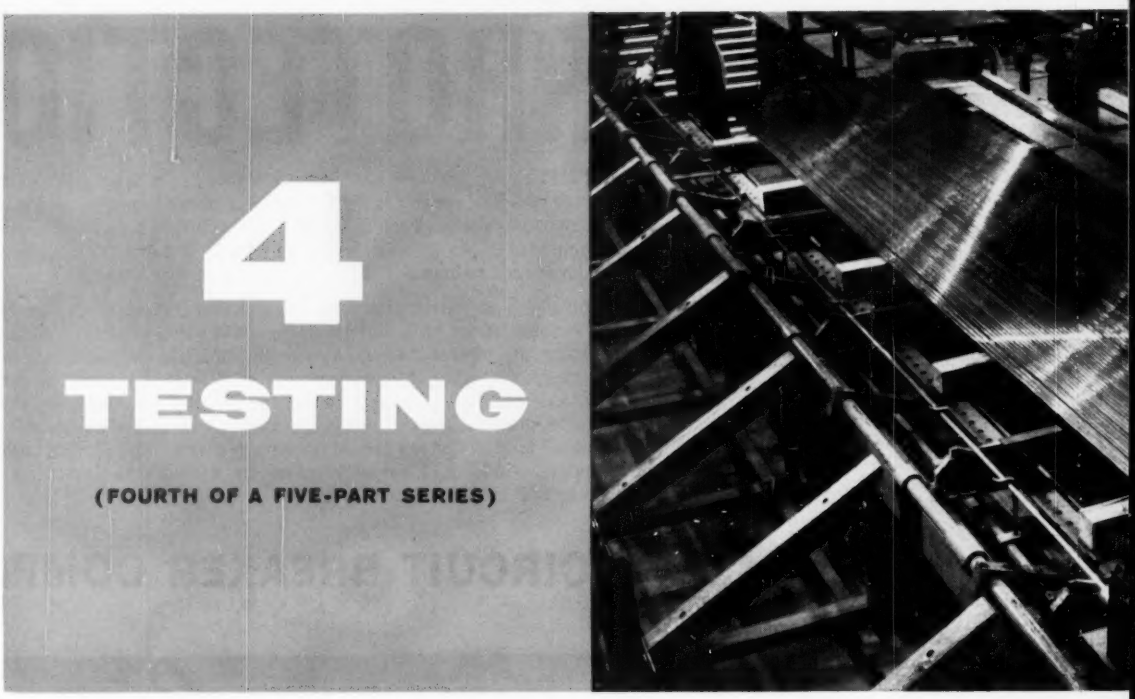
City_____ Zone_____ State_____

SEND COUPON OR WRITE

Get complete up-to-date information on I-T-E equipment

**An I-T-E trademark*

How lasting quality is Heat Exchanger



The quality of Phelps Dodge heat exchanger and condenser tubes is continually controlled at every stage of the entire fabricating operation by a special "in-mill" laboratory. In addition, the finished tubes are given exhaustive physical, chemical and metallurgical tests to assure quality and conformance with specifications.

All physical tests, including hydrostatic, flattening and expansion tests, are performed in strict accordance with ASTM and customer specifications. In the chemical laboratory, samples of the tubes are analyzed both chemically and spectrographically to determine the exact composition and conformance to the specifications. Experienced metallurgists minutely examine the grain structure of the metal in samples of both "in-process" and finished tubes. The grain size and temper are also carefully determined.

Throughout the entire tube fabricating operation—from raw materials to finished product—quality is the keynote. That's why Phelps Dodge tubes are preferred by those who demand the finest . . . the manufacturers and users of heat exchangers and condensers.

built into Phelps Dodge and Condenser Tubes...

Finished tubes receive the hydrostatic test, a quality control check in which water is pumped into the tubes at high pressures.

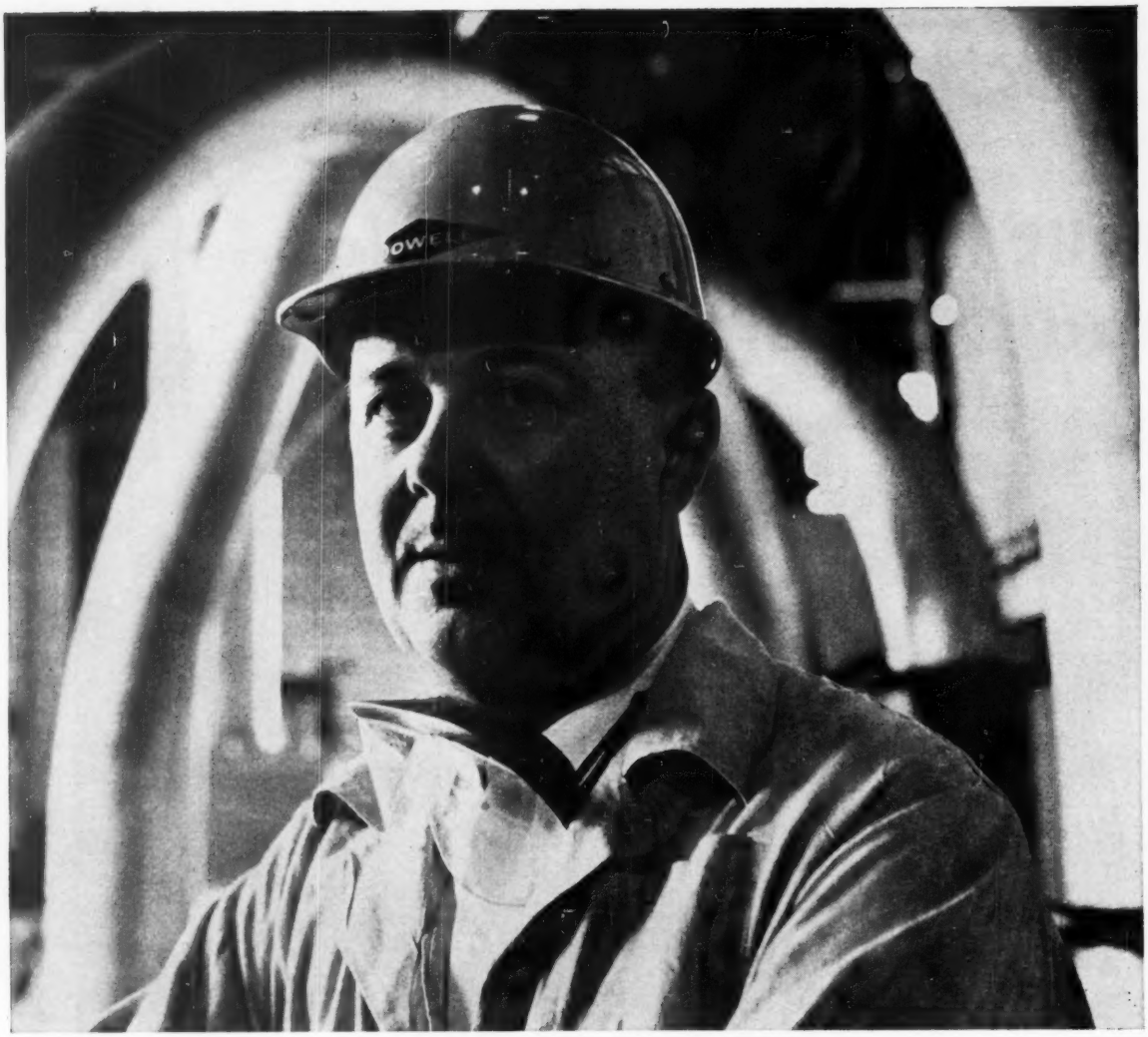
Another quality control test is this multi-frequency eddy current device which helps assure flawless tubes.

PHELPS DODGE COPPER PRODUCTS CORPORATION

First for Lasting Quality—from Mine to Market!

SALES OFFICES: Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Fort Wayne, Greensboro, N. C., Houston, Indianapolis, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.

For more facts circle 215 on Reader Service card, p 101



This Man Can Help You Get More Efficiency From Plant Equipment

Efficiency is what you want from your plant equipment, and the Dowell engineer can help you get it. Plants in every major industry—for example, oil refining, chemical, public utility, steel and paper—are getting productive results from *economical* chemical cleaning by Dowell.

To remove scale and sludge from your process equipment, boilers, tanks and piping, Dowell engineers provide knowledge and tools you can get from no other chemical cleaning service. You get cleaning knowledge gained from developing and working with the rigorous cleaning standards of the missile program at Cape Canaveral. You get new tools and chemicals from a continuous research program. For example, Dowell recently introduced a new high-velocity jetting device for cleaning tube bundles.

And you get 20 years' worth of experience in all types of industry from Maine to California. Plant operators find it pays to call Dowell on even the smallest job. But they also know that Dowell has the manpower and equipment to clean the largest and most complex systems.

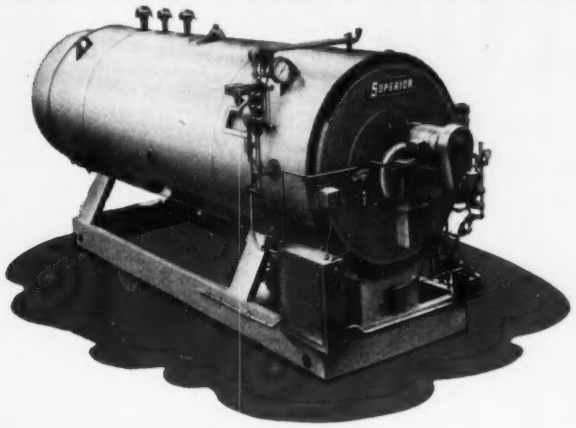
The Dowell engineer takes pride in doing your job so well that you will continue to call him for your cleaning work. This desire to do your job well covers every facet of service—from seeing that you get solvents exactly as specified, to supervising Dowell's full-time safety program. Every precaution is used to protect your personnel and equipment.

Prompt service and detailed information is yours from any of the 165 Dowell stations and offices. Get more efficiency—economically—with the help of the largest, the oldest, the most experienced chemical cleaning service—Dowell, Tulsa 1, Oklahoma.

Chemical cleaning service for all industry DOWELL

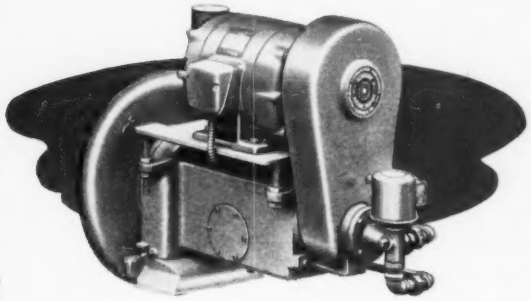
DIVISION OF THE DOW CHEMICAL COMPANY

ALL PACKAGED BOILERS ARE NOT THE SAME



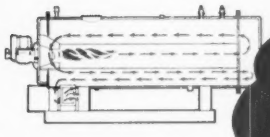
IS IT A TRUE PACKAGE?

Superior Packaged Boilers are complete . . . including burner, draft equipment, controls and all interconnecting piping and wiring. Completely factory assembled, and fire-tested at the factory before shipment.



IS IT ROTARY-BURNER EQUIPPED?

This is important for fully-automatic operation. The Superior Burner is capable of starting a cold boiler without compressed air, requires a minimum of supervision, and no lubrication whatsoever.



4-pass design
5-square feet

IS ITS HEATING SURFACE ADEQUATE?

Most boilers have adequate heating surface when new. Its effectiveness is lessened, however, as the boiler is used. To insure against this, look for a full five square ft. per boiler horsepower, and Superior's 4-pass, down-draft design.

CHECK THESE IMPORTANT FEATURES

before you buy...

There's a big difference in package boilers, that is not always obvious from external appearances. In the first place, many of the so-called packages are not packages at all, but combinations of boiler on the one hand and a burner-draft-control package on the other, shipped from separate manufacturers and assembled as a unit at the installation site.

Even in the true packages there are important differences in burner equipment, draft arrangements, and in the actual rating of the boiler itself.

Superior Packaged boilers are true packages, fully assembled and fire-tested at the factory before shipment. They are equipped with dependable Superior Rotary Burners, induced draft, integrated controls, and all interconnecting piping and wiring. They are conservatively rated, based on a full 5 sq. ft. of heating surface per boiler horsepower.

The location of the furnace within the boiler shell is carefully planned to provide protection against both low-water and mud-buildup failures.

Ask your engineer about Superior Packaged Boilers, his counsel is your best assurance of a boiler which will provide years of dependable operation at high efficiencies.

Type C Superior Packaged Boilers are manufactured in fourteen sizes, from 20 to 350 bhp., and with slight design modifications to 600 bhp. Sizes above 350 bhp. are designated as Type CF. All sizes are fully automatic firing oil, gas or both, and for pressures to 250 psi. Hot water units are also available. For complete information write giving capacity range desired, and ask for bulletin 11C.

Specialists in PACKAGED BOILERS... exclusively

SUPERIOR COMBUSTION INDUSTRIES, INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
PACKAGED BOILERS

be sure to consider...

TOTAL VALUE

General Electric Master Unit Substations are your best "total value" buy—most advanced transformer, switchgear designs . . . completely integrated for modern, economical power distribution

For a "total value" product appraisal, consider these over-all advantages of factory-built unit substations, then factor in the product superiority of G-E transformer and switchgear components.

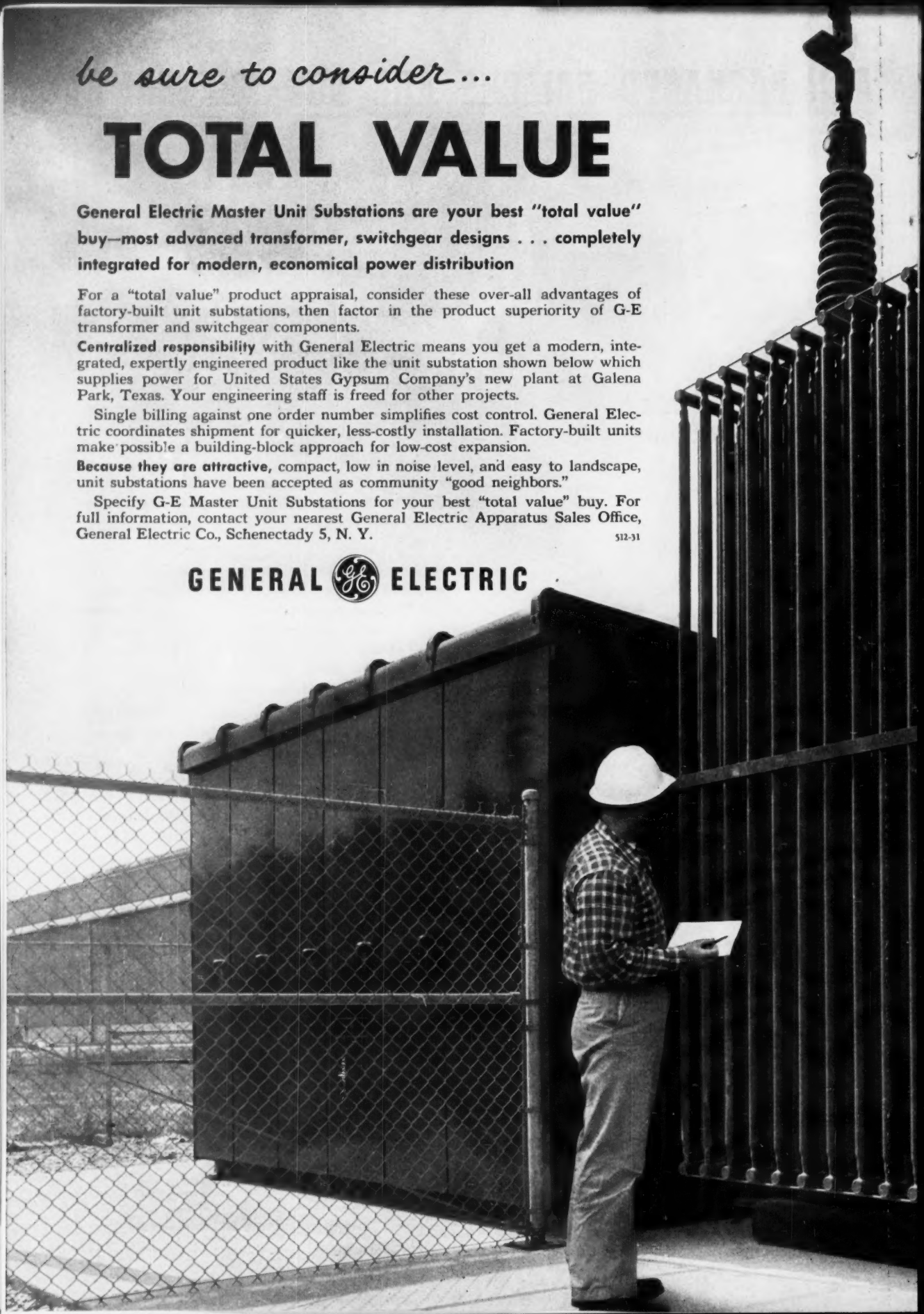
Centralized responsibility with General Electric means you get a modern, integrated, expertly engineered product like the unit substation shown below which supplies power for United States Gypsum Company's new plant at Galena Park, Texas. Your engineering staff is freed for other projects.

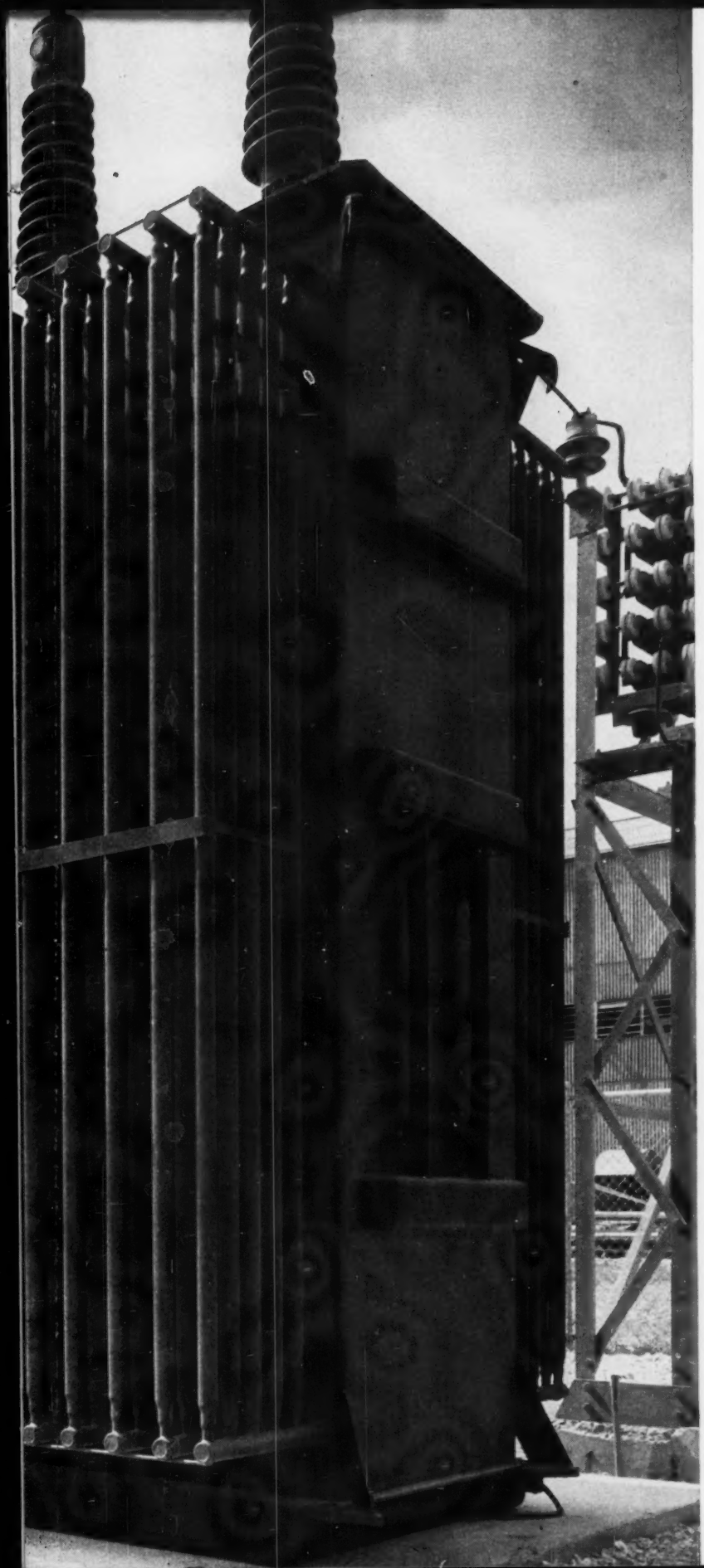
Single billing against one order number simplifies cost control. General Electric coordinates shipment for quicker, less-costly installation. Factory-built units make possible a building-block approach for low-cost expansion.

Because they are attractive, compact, low in noise level, and easy to landscape, unit substations have been accepted as community "good neighbors."

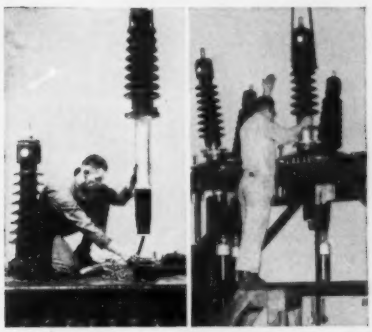
Specify G-E Master Unit Substations for your best "total value" buy. For full information, contact your nearest General Electric Apparatus Sales Office, General Electric Co., Schenectady 5, N. Y. 512-31

GENERAL ELECTRIC

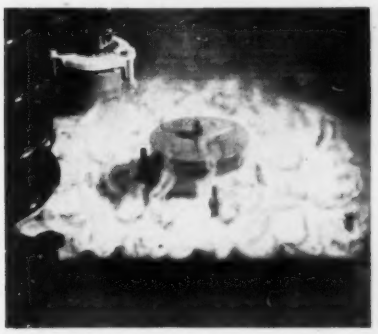




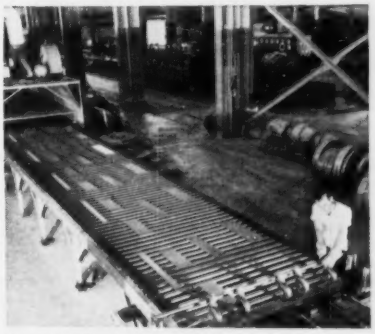
These transformer features are part of G-E Unit Substation value



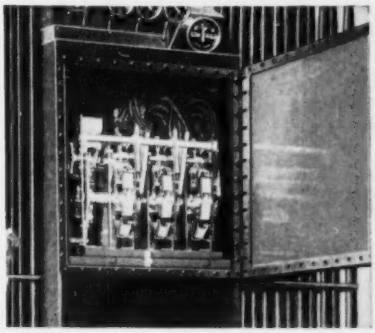
INTERCHANGEABLE BUSHINGS can be converted easily from transformer to breaker application to cut bushing inventory significantly.



PRESSURE-RELIEF DEVICE gives tank protection from excessive internal pressures. Direct-acting mechanical device is rugged, self-resealing.

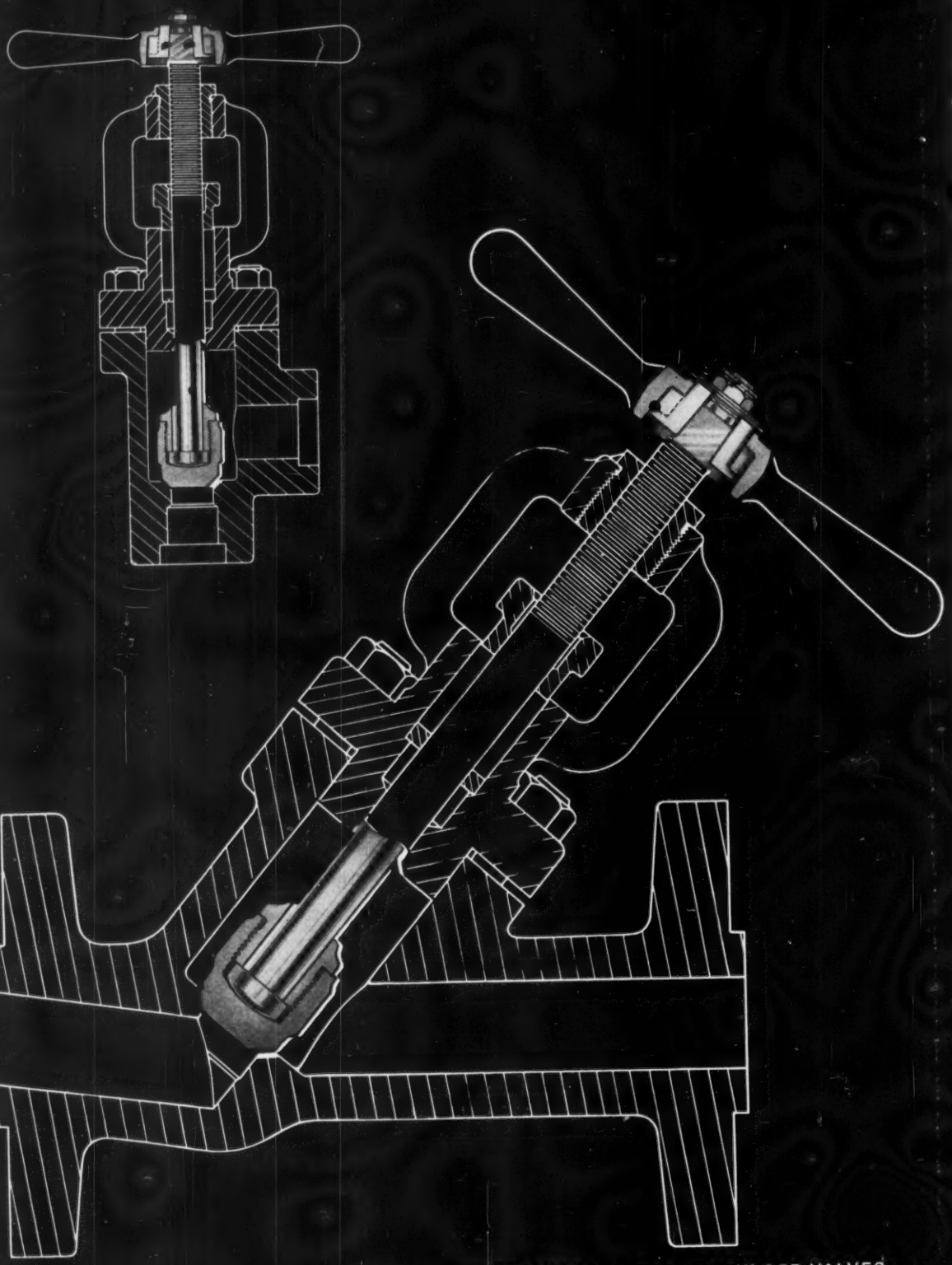


TEN PERCENT LOWER CORE LOSSES, sound levels 2 to 3 db below industry standards result from new core steel annealing process.



NEW LOAD TAP CHANGER cuts routine maintenance 50% by doubling contact-tip life. Peak operating noise is reduced 20 db.

circle 218 on Reader Service card, p 101



EDWARD FORGED STEEL BLOW-OFF VALVES

What's New from Edward Valves

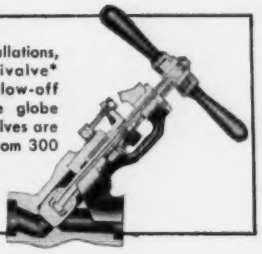
New Products . . . Problems and Solutions. . . Information on Steel Valves from Edward, Long-Time Leader in the Field!

Edward Drop Forged Blow-off Valves

. . . the first—and still the newest!

Fifty years ago, when boilers operated at 250 lb sp the first really efficient means of blowing-down was with "new" Edward blow-off valves. Today, with pressure in the 1800-2600 lb range and with water temperatures sometimes exceeding 600 F, corresponding improvements in Edward blow-off valves have been effected. For example, today all Edward blow-off valves have integral Stellite seats and Impactor* easy closing handles.

All over the world, high temperature-pressure steam power stations rely on these Rockwell-built Edward blow-off valves. The reasons are basic. Edward valves are simple and rugged in design, with no "trick construction." They operate easily, stay tight, need very little maintenance. If parts replacement is ever necessary, repairs are easier and less expensive than with any comparable valve. Write for facts on performance, price, and delivery. Address *Edward Valves, Inc., 1230 West 145th Street, East Chicago, Indiana.* (Subsidiary of Rockwell Manufacturing Company.) Represented in Canada by Lytle Engineering Specialties, Ltd., 360 Notre Dame St. W., Montreal 1, Quebec.



Popular for high pressure installations, the Edward welded-bonnet Univalve* meets Code requirements for blow-off service and is ideal all-purpose globe valve as well. Edward blow-off valves are available in all pressure classes from 300 lb to 2500 lb in angle or straight-way styles, with flanged or welding ends.

Premium Features of Edward Blow-off Valves

- INTEGRAL SEAT of chromium-cobalt-tungsten alloy. Applied directly to body in a continuous ring, then machined in same set-up with bonnet guide bore for perfect alignment. Highly resistant to abrasion and corrosion.
- HARD-FACED DISK—Stellited for maximum resistance to abrasion and corrosion. Edward swivel-disk construction allows stem to lift vertically away from seat. No grinding or galling.
- POSITIVE BACKSEAT isolates packing from the high temperature zone. Line-contact backseat seals EValpak* valve packing from line pressure, permits repacking under pressure.
- IMPACTOR HANDLE, an Edward exclusive, is standard equipment. Several times more effective than ordinary handles or handwheels in opening or closing valves.

Recommended practice: Open valve *nearer* boiler first. Then slowly open other valve. After blow-off, close second valve first; then valve nearer boiler. This places greatest wear on blowing valve, assures a tight valve next to boiler, facilitates repair without a boiler shut-down.

EDWARD STEEL VALVES

another fine product by

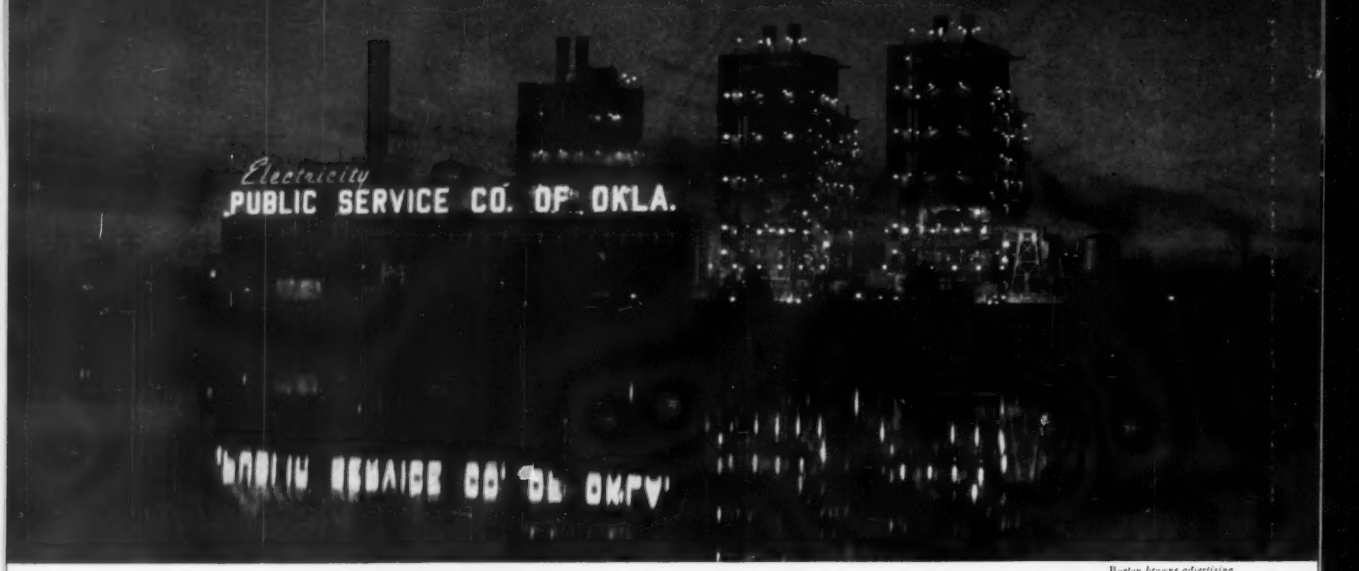
ROCKWELL

Edward builds a complete line of forged and cast steel valves from ⅛" to 18"; in globe and angle stop, gate, non-return, check, blow-off, stop-check, relief, hydraulic, gage and special designs; for pressures up to 10,000 lbs; with pressure-seal, bolted, union or welded bonnets; with screwed, welding or flanged ends.

*T. M. Reg. U. S. Pat Off.

For more facts circle 219 on Reader Service card, p 101

REFLECTS EFFICIENCY



Burton browne advertising

because PANALARM REDUCES LOGGING TIME TO SECONDS...CURTAILS COSTLY OUTAGES

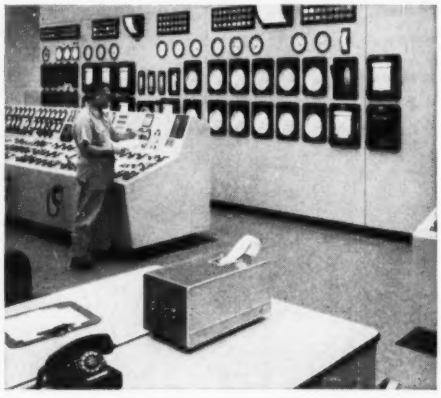
Public Service Co. of Oklahoma reports greater continuity of service and fewer costly outages from using PANALARM Annunciators in its new Tulsa station

PANALARM "flashing-ringback sequence" Recording Annunciator System converts raw data into usable information in seconds—a tremendous improvement over slow, old fashioned manual logging. Costly outages are fewer because of the speed and reliability with which off-normal conditions are registered.

The Recording Annunciator System sounds an alarm when trouble occurs. Simultaneously, it prints an accurate alpha-numeric digital record of the date and time of trouble and identifies the equipment that failed and/or returned to normal, eliminating possibility of operator error.

Another big advantage is that it continues receiving and recording information during emergencies, relieving the operator of this burden. The operator then concentrates his entire attention on ending the emergency. Later, a precise, sequential record is available for both operators and engineers to study as a basis for preventive maintenance and action.

For an optimum competitively priced Recording Annunciator System for your plant, talk to Panellit engineers. Sales and engineering offices in all principal cities.



PANALARM ANNUNCIATORS record critical information on 7 turbine generators related to differential shutdown, overvoltage, ground detection, motor control, loss of field, pressures, temperatures, and shutdown or bus tie transfer operations.

PANALARM

For complete technical details on the Recording Annunciator, write for Bulletin 102A today.

Division of

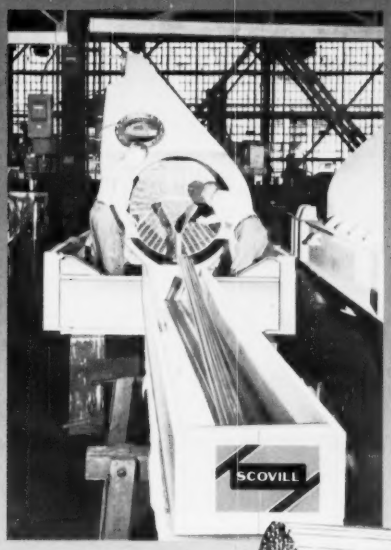
PANELLIT, INC. 7401 North Hamlin Ave., Skokie, Illinois

Annunciators • Control Panels • Data Systems • Contract Maintenance and Installation

For more facts circle 220 on Reader Service card, p 101

Circle 237 on Reader Service card, p 101 ➤

where trouble-free performance is a matter of **national security**



each of newest nuclear subs will take aboard **MORE THAN 4 MILES** of Scovill cupro-nickel, 30% heat exchanger tube

SCOVILL

We're proud to be making this important contribution to the long-service dependability of these nuclear-powered submarines.

Like all other components of their nuclear-powered propulsion machinery and equipment, the Foster Wheeler main condensers, shown above being tubed with Scovill Cupro-Nickel, 30% Heat Exchanger Tube, have passed the most exhaustive performance tests it has been possible to devise. The same tube specification is also being installed in the ejector condensers. All of the tube is electronically tested on new equipment at the Scovill Tube Mills before delivery.

Scovill Cupro-Nickel, 30% Heat Exchanger Tube has a long record of trouble-free service on U. S. Naval vessels and those of many other nations. It is a first choice of design and operating engineers where salt water or corrosion conditions are severe, particularly at elevated temperatures and when the circulating media travel at high velocities. The corrosion resistance is excellent; strength of the alloy remains constant over a wide temperature range.

Why not discuss your own heat exchanger tube conditions and problems with Scovill Technical Service . . . considered by many the most experienced in the field.

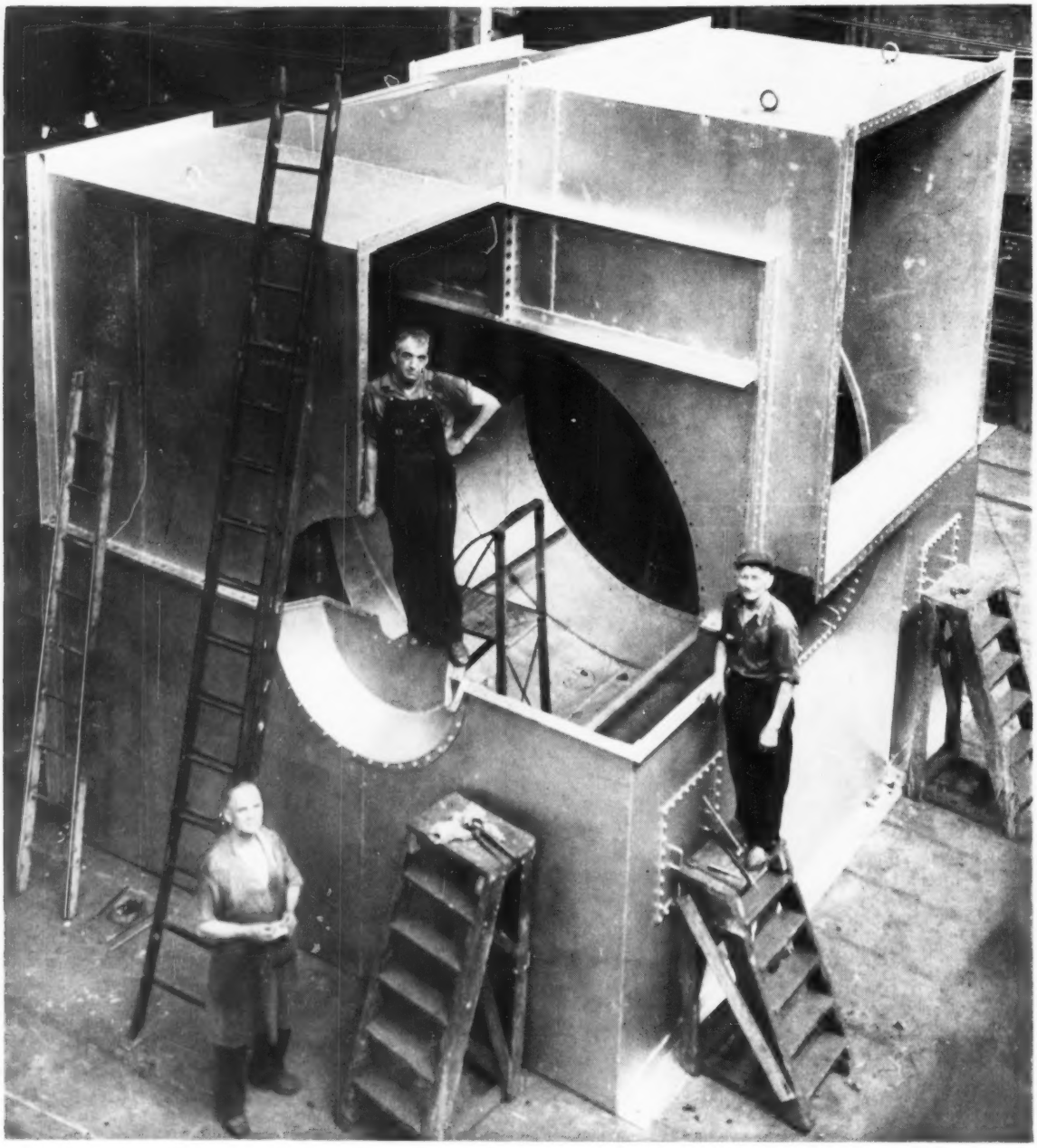
HEAT EXCHANGER TUBE

for Applications from Marine to Petrochemical, from Compressor Intercoolers to "Cat-Cracker" Exchangers, in these popular Alloys . . . Phosphorized Admiralty • Admiralty • Arsenical Admiralty • Red Brass, 85% • Deoxidized Copper • Arsenical Copper • Cupro-Nickel, 10%-20%-30% • Aluminum Brass • Aluminum Bronze, 5% • Muntz Metal • Duplex Tube.

SCOVILL MANUFACTURING COMPANY, Mill Products Division, 99 Mill Street, Waterbury 20, Connecticut. Phone PLaza 4-1171.

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

18SC59

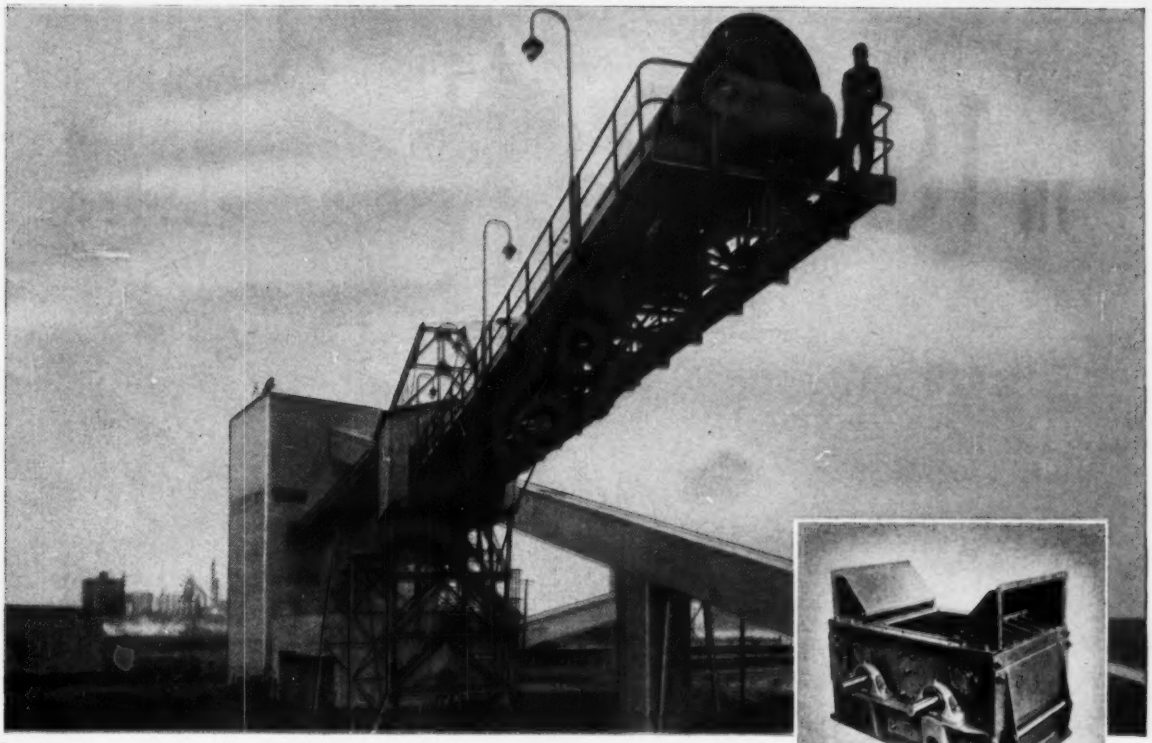


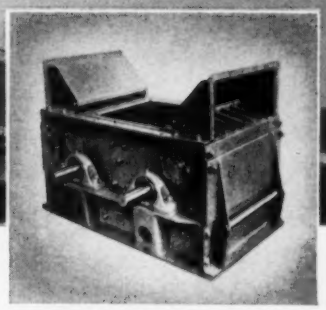
You wouldn't buy a bargain basement parachute... or a cut-rate big game rifle...

Don't choose less than Clarage quality for your mechanical draft service. With anything as vital as uninterrupted operation, it pays big dividends to get the best in equipment. Clarage, a specialist in building forced and induced draft fans, offers you equipment having a long-standing reputation for long-lasting service. CLARAGE FAN COMPANY, Kalamazoo, Michigan.

For more facts circle 222 on Reader Service card, p 101

STEPHENS-ADAMSON





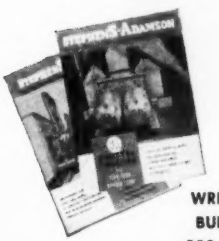
S-A RING TYPE, DOUBLE ROTOR KNITTEL CRUSHER — Crushes lumps while in suspension. Maintains full capacity with wet coal — no clogging. Greater capacity — less space required.

COAL HANDLING SYSTEMS
increase tonnage, lower costs!

When STEPHENS-ADAMSON engineers and builds a coal handling system, over a half-century of "know-how" in the design of unloading, storing, crushing, reclaiming, sampling, and distributing systems is put to use. S-A experience dates back as far as the early beginnings of electric power and includes the engineering of giant systems such as the mammoth Detroit-Edison and New York State Electric installations to a newly engineered power plant in Bombay, India. Large or small, an S-A engineered system means more kilowatts per ton and years of dependable service.

Backing up the "know-how" and experience is a quality-engineered line of components, each providing an exclusive combination of features — many of them carrying patents by S-A engineers. Put S-A engineering skill to work for you . . . write for full information today!

S-A HYDRAULICALLY POWERED CARQUAKE — Maximum efficiency in unloading hopper cars with minimum noise. One man operation. No expensive overhead structures — a completely self-contained unit.

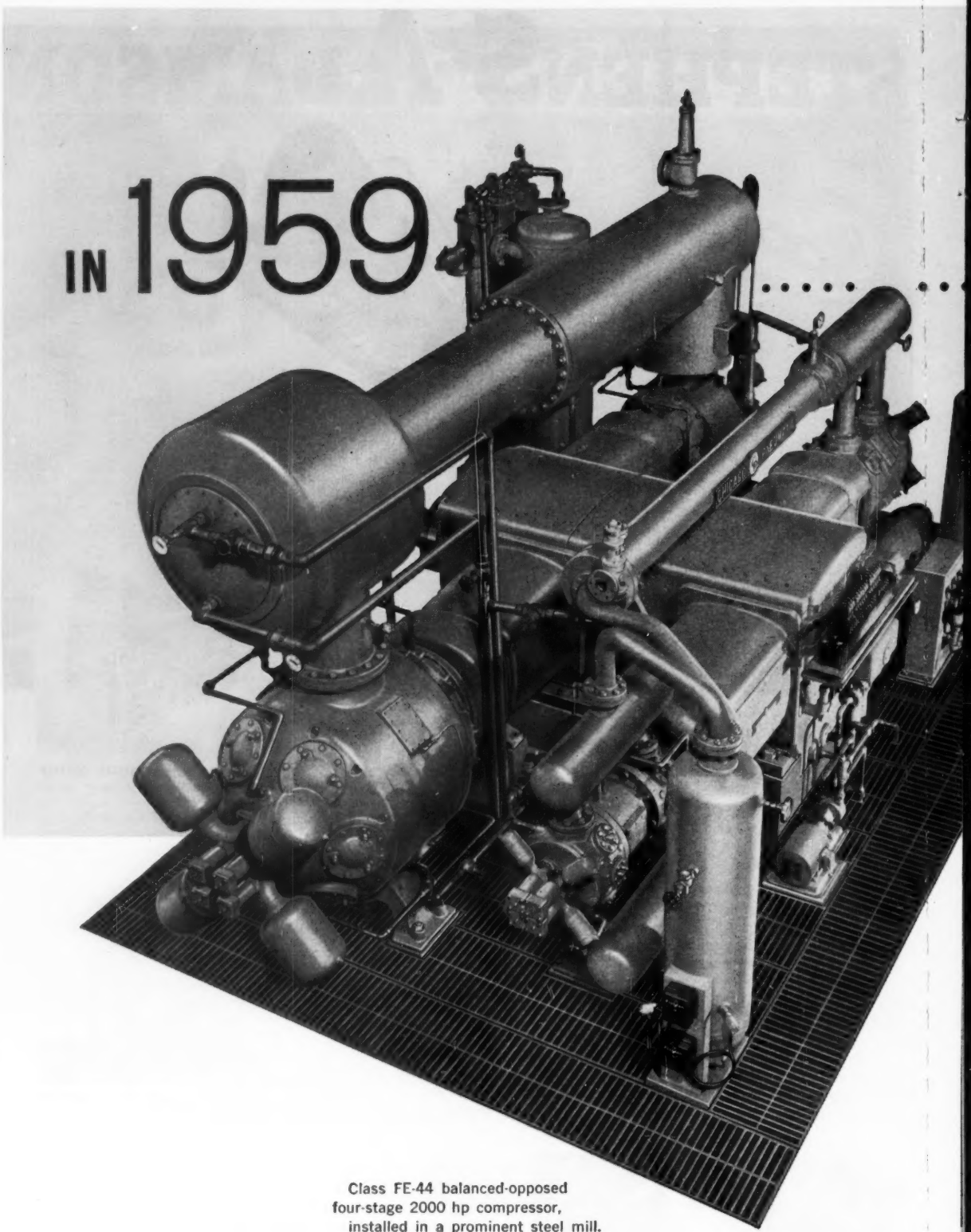


WRITE FOR BULLETINS 858 and 658

S-A
MATERIALS HANDLING PRODUCTS
SEALMASTER BALL BEARING UNITS

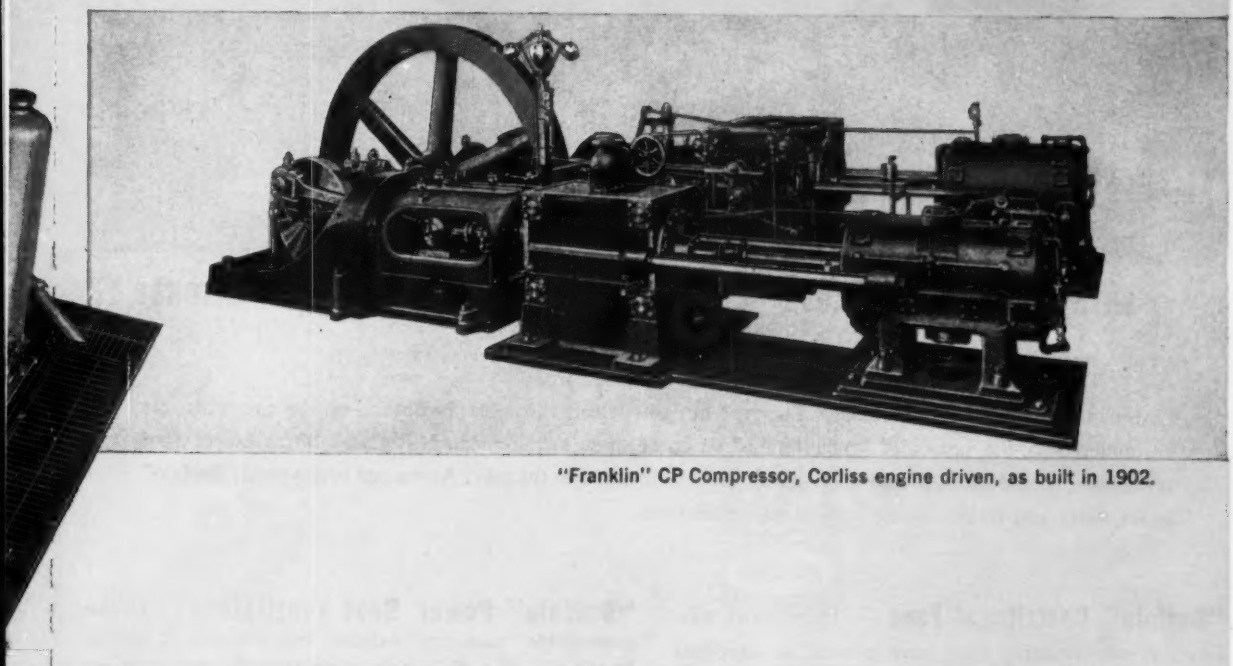
ENGINEERING DIVISION
STEPHENS-ADAMSON MFG. CO.
GENERAL OFFICE & MAIN PLANT, 5 RIDGEWAY AVENUE, AURORA, ILLINOIS
PLANTS LOCATED IN: LOS ANGELES, CALIFORNIA • CLARKSDALE, MISSISSIPPI
BELLEVILLE, ONTARIO

For more facts circle 223 on Reader Service card, p 101



Class FE-44 balanced-opposed four-stage 2000 hp compressor, installed in a prominent steel mill.

.....AS IN 1902



"Franklin" CP Compressor, Corliss engine driven, as built in 1902.

The CP name on an Air Compressor stands for UNEXCELLED PERFORMANCE

Maintaining a good reputation requires constant improvement of the product. For more than half a century "CHICAGO PNEUMATIC" has meant unexcelled compressor performance.

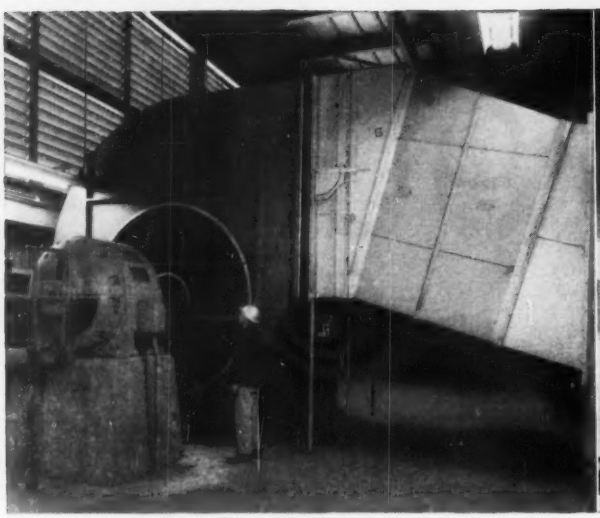
CP Compressors are built in sizes to 5000 hp for pressures up to 15,000 psig, or for vacuum service. Motor or steam drive. Lubricated or non-lubricated cylinders.

Chicago Pneumatic 8 East 44th Street, New York 17, N. Y.

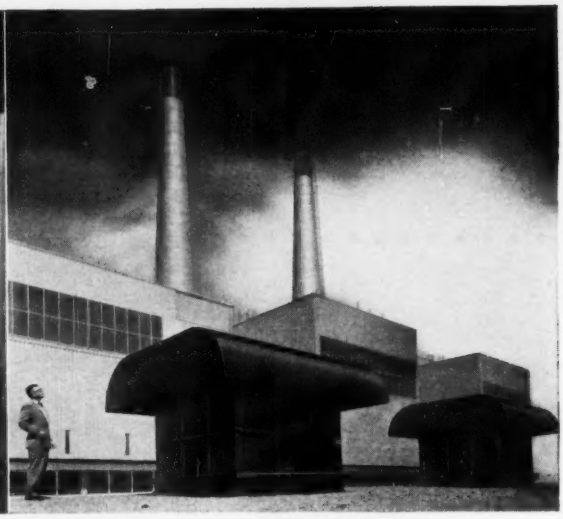
AIR AND GAS COMPRESSORS • VACUUM PUMPS • PNEUMATIC TOOLS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS

For more facts circle 224 on Reader Service card, p 101

How do you plan to ventilate and heat your power plant?



WITH CENTRIFUGAL FANS?



WITH POWER ROOF VENTILATORS?

Both methods have their advantages. The type fan you select will naturally depend on the circumstances encountered in the layout of your station. To meet these requirements, "Buffalo" offers power roof ventilators, centrifugal fans and make-up air units well suited to the task. Above are two typical "Buffalo" boiler room and turbine room ventilation installations.

"Buffalo" Centrifugal Fans — These quiet, efficient, non-overloading fans have proved an excellent choice for boiler house ventilation. If desired, hot air may be ducted to other areas as needed. "Buffalo" Centrifugal Fans provide completely stable performance from free delivery to shutoff. Turbulence is reduced to a minimum by unique "Buffalo" design features. All wheels are factory-balanced to minimize vibration. Rugged construction throughout gives a long life of trouble-free service. Write for full details in Bulletins F-104 and F-201.

"Buffalo" Power Roof Ventilators — These dependable "packages" exhaust high volumes of hot air from large areas. They save money from the start, because little, if any, expensive duct work is required. Peak-efficiency "Buffalo" fans insure minimum operating costs. Installation does not interfere with valuable floor space. "Buffalo" Sky-Vent Power Roof Ventilators are complete units, quickly and easily installed. Capacities 1,000 to 250,000 CFM. Assembled packages include fan, motor, housing, roof curbing, stack and hood. Can also be arranged for supply with heating coils and dampers. Write for Bulletin FM-2345.

Your nearby "Buffalo" engineering representative will be glad to work with you on your boiler room ventilation problems. Phone him today, or write us direct.

"Buffalo"

BUFFALO FORGE COMPANY Buffalo, New York
Buffalo Pumps Division, Buffalo, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

O-B VALVES

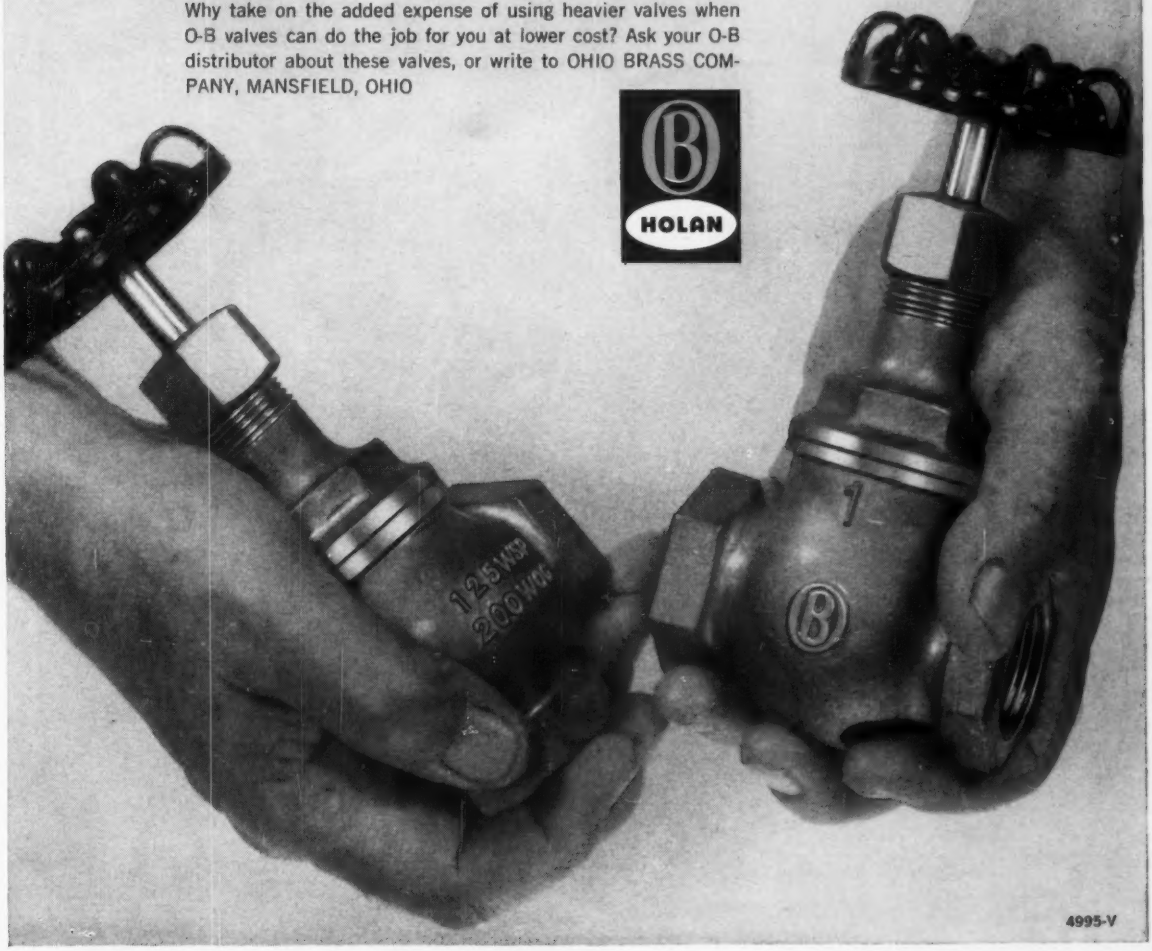
Why buy more valve than you need?

Are you using 150 and 200 pound bronze valves on lines carrying 125 pounds steam? Do you believe that quality bronze valves aren't available below 150 pounds steam pressure?

Take a look at these Nos. 1501 and 1502 O-B globe and angle valves. They are the answer to your problem and can save you money. They have all the quality features found in higher pressure (and higher priced) valves... packing gland inside the packing nut... two-piece stem and disc holder construction... backseating design for repacking under pressure... heavy body, neck and bonnet.

Why take on the added expense of using heavier valves when O-B valves can do the job for you at lower cost? Ask your O-B distributor about these valves, or write to OHIO BRASS COMPANY, MANSFIELD, OHIO

HOLAN



4995-V

For more facts circle 226 on Reader Service card, p 101

Quarter-scale model of experimental gas turbine being developed by Cooper-Bessemer and Pratt & Whitney Aircraft. Units should be available for use within 18 months.

How Cooper-Bessemer is teaming up with Pratt & Whitney Aircraft to develop JET TURBINE POWER for industry

The cutaway model shown is a revolutionary new concept in gas turbines. The generating unit is a new Pratt & Whitney Aircraft jet engine—a modification of the famous J-57 aircraft engine, designed for gas fuel. The companion power unit is a new Cooper-Bessemer power turbine. This combination, now in the advanced experimental stages, represents the hottest development in industrial power in 20 years. It will mean drastic economies in installations of engine-driven compressors, generators and other rotating machinery.

For example, in gas compressor stations, it is expected to reduce total station cost by 50%!

Plans call for this new gas turbine to be available for broad application within 18 months. In the meantime, watch for reports on further developments in this pioneering teamwork by Cooper-Bessemer and Pratt & Whitney Aircraft.

BRANCH OFFICES: Grove City • New York • Washington • Gloucester
Pittsburgh • Chicago • Minneapolis • St. Louis • Kansas City • Tulsa
New Orleans • Shreveport • Houston • Greggton • Dallas • Odessa • Pampa
Casper • Seattle • San Francisco • Los Angeles

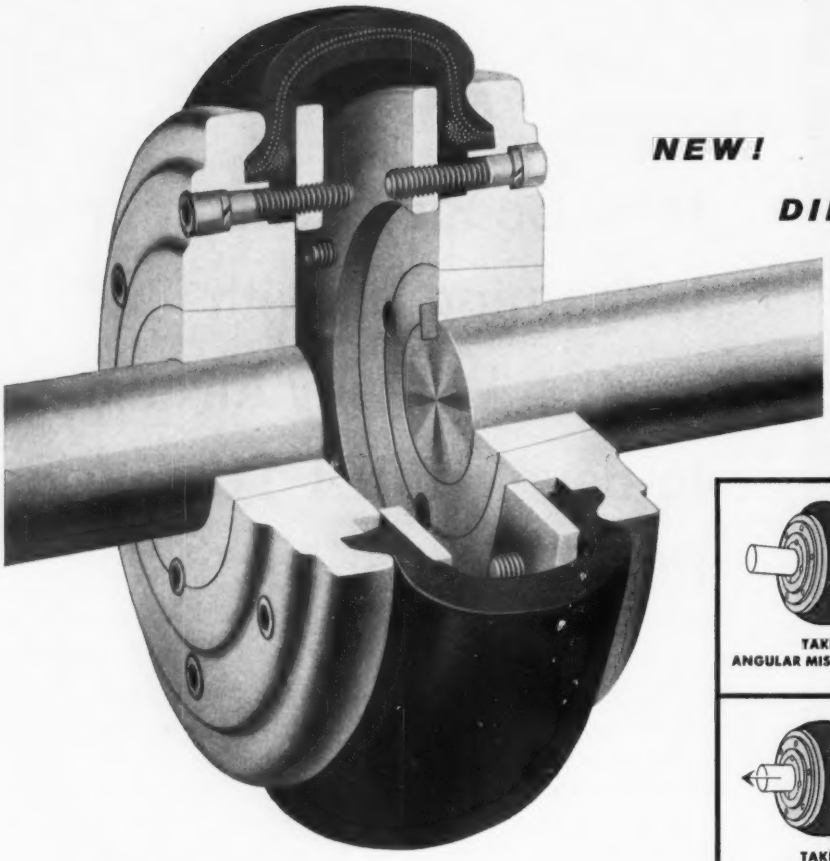
SUBSIDIARIES: Cooper-Bessemer of Canada, Ltd.... Edmonton • Calgary
Toronto • Halifax
C-B Southern, Inc.... Houston
Cooper-Bessemer International Corporation... New York • Caracas • Mexico City
Cooper-Bessemer, S.A.... Chur, Switzerland • The Hague, Netherlands

Cooper Bessemer

GENERAL OFFICES: MOUNT VERNON, OHIO

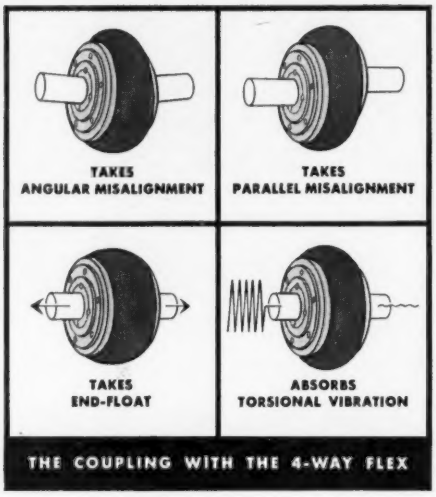
ENGINES: GAS • DIESEL • GAS-DIESEL
COMPRESSORS: RECIPROCATING AND CENTRIFUGAL,
ENGINE, TURBINE OR MOTOR DRIVEN

For more facts circle 227 on Reader Service card, p 101



NEW!

DIFFERENT!



DODGE

Para-flex

FLEXIBLE CUSHION COUPLING

THIS coupling "swallows up" shaft misplacements. It automatically compensates for end-float, parallel misalignment, angular misalignment *or any combination of all three.* Moreover, it cushions the stresses of shock loads. And it absorbs torsional vibration—reducing noise and protecting machinery from vibration's destructive forces.

Here is a new type of performance—made possible by the development of a tire-like flexing element. Synthetic tension members, bonded together in rubber, give this element the stamina and dependability of modern, high-speed, high-load, shock-absorbing truck tires—and the ability to respond magically to all manner of changing shaft conditions.

Para-flex takes minimum space on the shaft. Mounting is simplified through the use of standard Taper-Lock bushings—no reboring, no machining. Safety is promoted by flush design; there are no protruding parts. No lubrication is required, no periodic inspection. And since the flexible member is molded with a transverse split, it can be replaced *without moving either the driver or driven machine.*

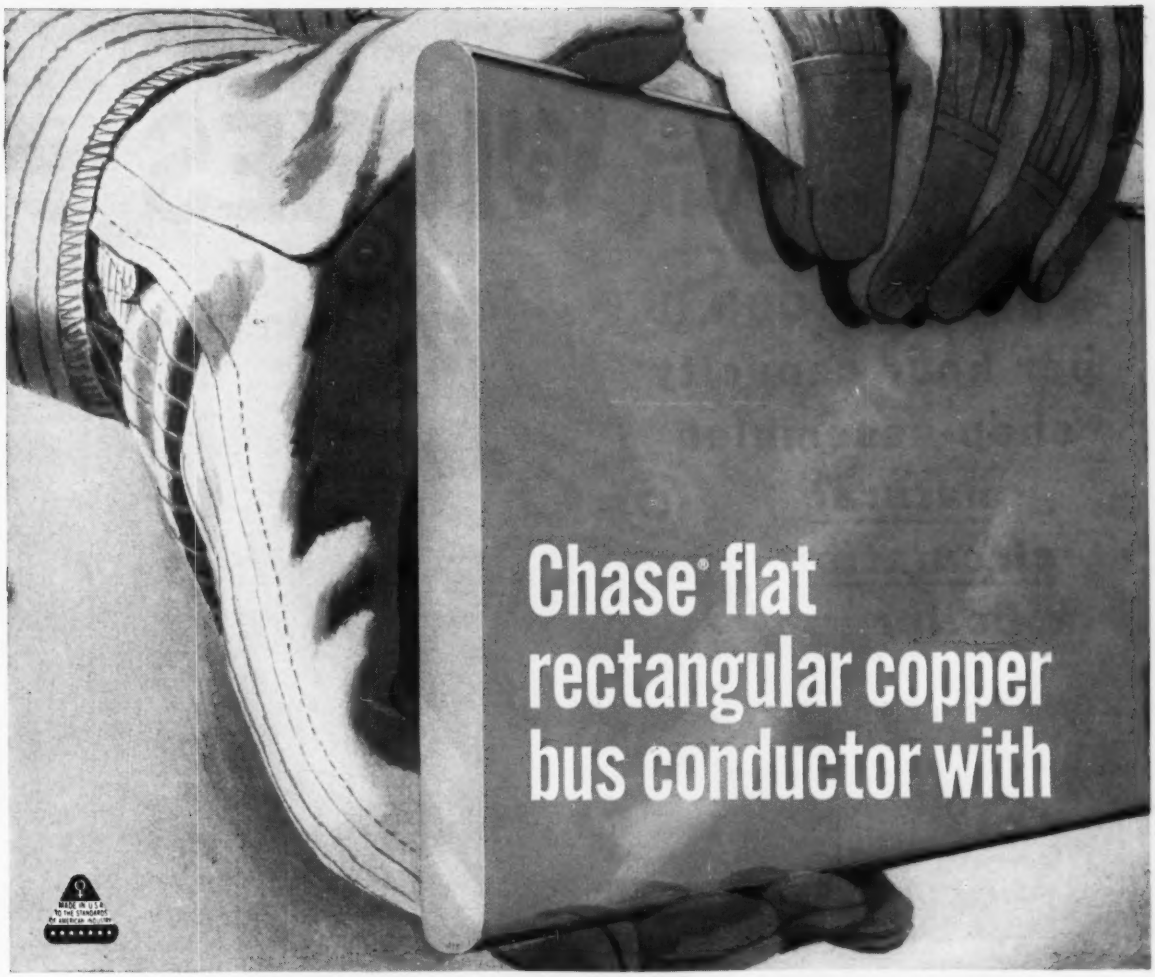
Para-flex Couplings are stocked by Dodge Distributors in popular transmission sizes. They are available from factory stock in capacities up to 2000 hp at 1080 rpm. Call your distributor for a coupling to *make your own test.* You'll witness something revolutionary!

DODGE MANUFACTURING CORPORATION, 3200 Union, Mishawaka, Ind.

DODGE

of Mishawaka, Ind.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look in the *white* pages of your telephone directory for "Dodge Transmissioneer."



FULL-ROUNDED EDGES

You can get top-quality copper bus conductor from Chase in flat bar shape with full-rounded edges, as well as bar with rounded edge or rounded or square corners.

The full-rounded edge bars have no edges to cut through insulating wrapping and cause trouble on the job. And they can be made up readily in multiple-bar units to handle very heavy direct current loads, or for alternating current.

Chase® flat rectangular, *full-rounded* edge bus conductor is ideally-suited to use in making up bus duct.

Chase also makes many special type bus conductors, for specific applications. If you have particular requirements, why not talk them over with a Chase Engineer? Call the nearest Chase Warehouse or Sales Office, or write Chase at Waterbury 20, Connecticut.

Chase® **BRASS & COPPER CO.,** WATERBURY 20, CONN.
Subsidiary of ***Kennecott Copper Corporation***

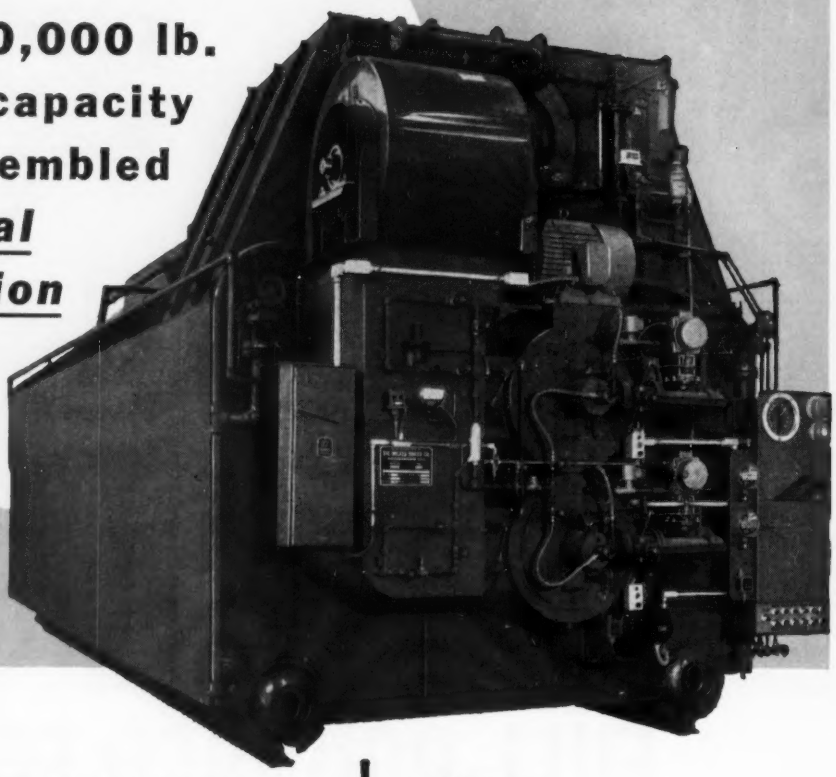
CHASE ELECTRICAL CONDUCTORS
are available in a variety of shapes
to suit every power-carrying need.

THE NATION'S HEADQUARTERS FOR **ALUMINUM • BRASS • BRONZE • COPPER • STAINLESS STEEL**
Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York (Maspeth, L.I.) Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

For more facts circle 229 on Reader Service card, p 101

...now from WICKES

a new 100,000 lb. per hour capacity shop-assembled *natural circulation* boiler



Wickes Type A units are of simple design, ruggedly constructed and adaptable to a variety of operating conditions and may be fired with oil, gas or combination of both.

All units are shipped completely shop-assembled including superheater, fuel burning equipment, safety and combustion controls, forced draft fan and drive, soot blowers and feedwater regulator.

Save on

- **First Cost**
- **Operating Expense**
- **Space**
- **Delivery Time**
- **Installation Time**

For more detailed information on Wickes Type-A steam boilers, write for our catalog 56-1. Bulletin 55-1 covers the complete line of Wickes Products and Facilities.

WICKES type A

WICKES

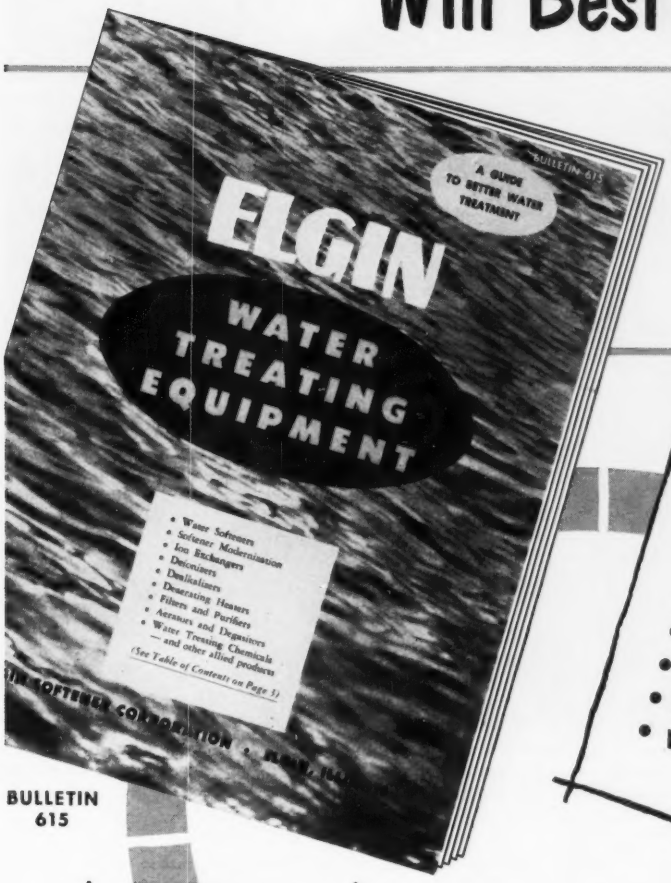
WICKES BOILER CO., SAGINAW 10, MICHIGAN

DIVISION OF THE WICKES CORPORATION

RECOGNIZED QUALITY SINCE 1854 • ***SALES OFFICES:*** Boston • Chicago • Cleveland • Dallas • Denver • Detroit • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • New Orleans • Portland, Ore. • Saginaw • San Francisco • Springfield, Ill. • Tulsa.

For more facts circle 230 on Reader Service card, p 101

Which Water Treating Equipment Will Best Fit the Job?



BULLETIN 615

This new 24-page bulletin will help you decide

See what it covers:

- Zeolite Water Softeners
- Demineralizers
- Dealkalizers
- Deionizers
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- Water Treating Chemicals

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If you are confused about the many ways to treat water, this new bulletin will help you decide which is best for the job. It describes the various equipment used in treating water and what each is designed to do. Known for quality, dependability and advanced design, this equipment is based upon 50 years experience. For practical guidance in its proper application, the services of the Elgin representative nearest you is yours for the asking.

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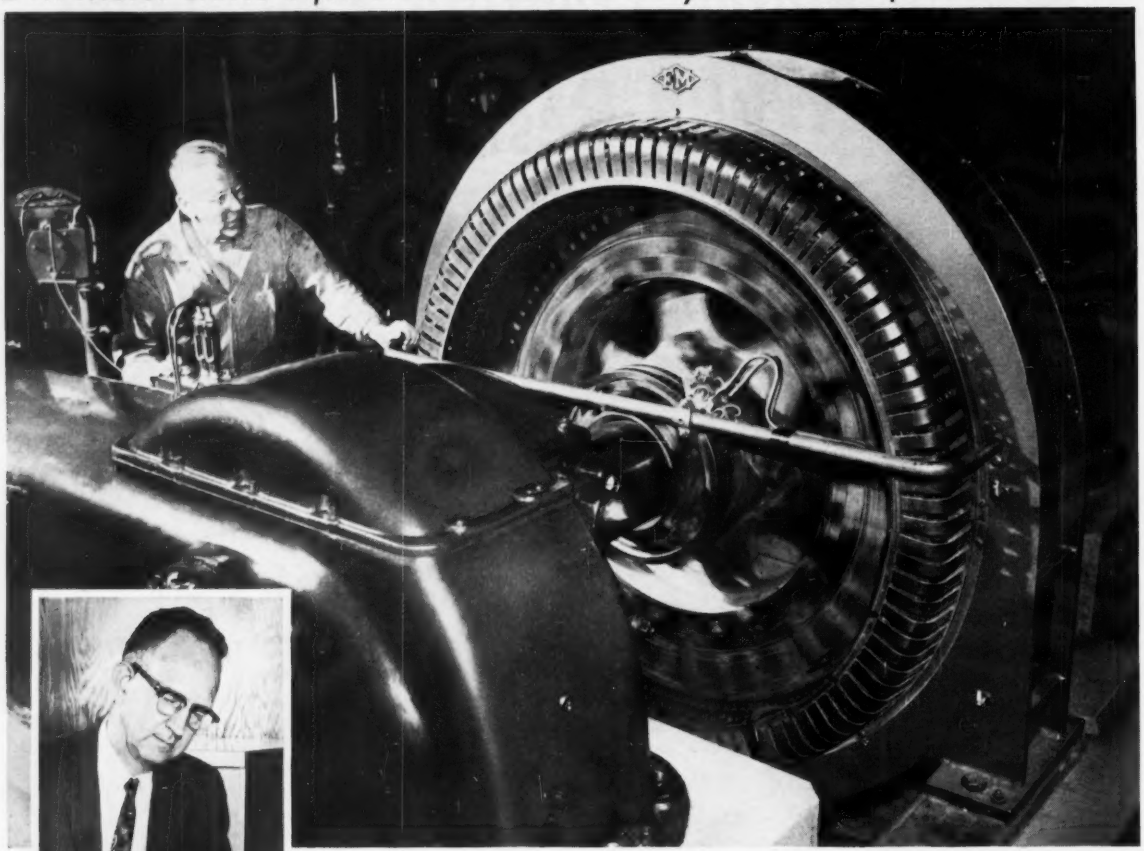
E-M Motor starts equivalent of second 50 years of compressor service!



After running approximately 108,000 hours, this E-M Synchronous Motor is still on compressor duty at Diamond Tool and Horseshoe Co. Contributing to the remarkably long life of the motor was the careful attention of Mr. J. Gordon Mitchell (above), Diamond Tool's electrical maintenance man. The motor is rated 350 hp, 200 rpm, 1.0 PF, 440 volts.

Mr. Hampton Connell, Vice President, Engineering, of Diamond Tool and Horseshoe Co. His company recently celebrated its 50th Anniversary as a manufacturer of hand tools and drop forgings.

"We just can't seem to wear them out!"

Diamond Tool and Horseshoe Co. of Duluth, Minnesota has an E-M Motor on compressor drive that has been running for the equivalent of *40 hours a week for over 50 years—approximately 108,000 hours!* Yet this same motor is still in service 16 hours a day.

Mr. Hampton Connell of Diamond Tool tells this unsolicited story about his untiring E-M Motor:

"This particular motor was installed about 1942, and was in service 24 hours a day, 7 days a week during the last war. Following the war we operated this unit 24 hours a day, 5 days a week for a considerable period of time. For the past several years we have been running the machine 16 hours a day, 5 days a week.

"We have been using E-M Motors in our factory on our air compressors for a good many years now, and with very satisfactory results."

E-M Motors have earned a reputation for reliability and endurance in many industries. Get more information about them. Call your nearby E-M Sales Engineer and write the factory for free Compressor number of E-M *Synchronizer* 52.

ELECTRIC MACHINERY MFG. COMPANY

MINNEAPOLIS 13, MINNESOTA

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***Specialists in making motors do* EXACTLY WHAT YOU WANT THEM TO**

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of temperatures with
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PRECISION-MOLDED
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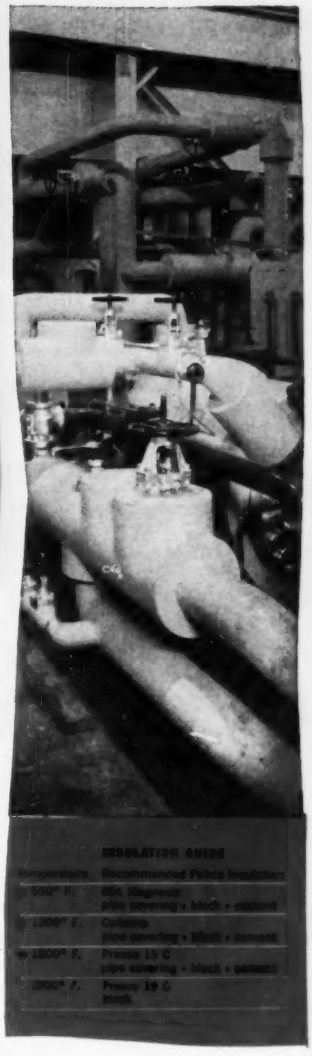
Insulation



Name your temperature. A performance-proved Pabco pipe or block insulation will maintain it at economical levels up to 1900° F. With Pabco Caltemp, 85% Magnesia, or Prasco Insulations, heat losses are reduced to an absolute minimum . . . finest performance assured. For data on technical advantages, case histories, or engineering consultation . . . write . . . or contact one of Pabco's insulation engineers.

PABCO INDUSTRIAL INSULATIONS DIVISION

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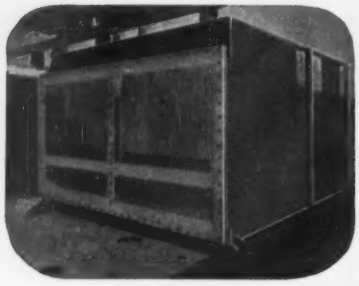
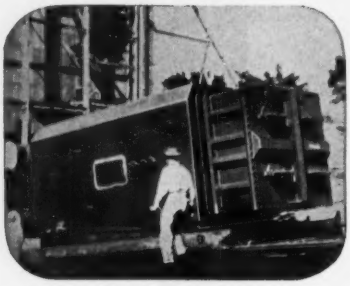
and auxiliary equipment

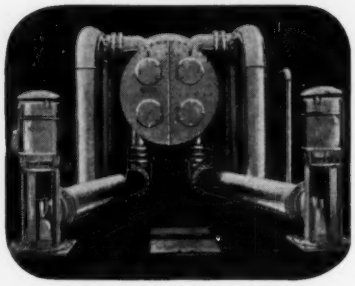
HOW C.H. WHEELER CONDENSER DESIGN saves space...



Head Room problems are solved by compact condensers like this one. Turbine floor to basement floor, in this case, is only 20 ft. The Unit has 65,000 square feet of condensing surface.

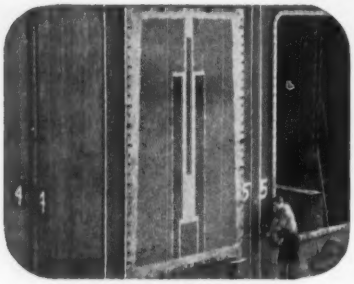


Rectangular Cross Section makes C.H. Wheeler Condensers adaptable to nearly any space or condenser arrangement because the length, width and height of any Wheeler Unit can be varied almost at will.

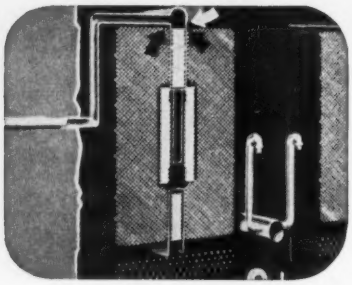


But Wheeler Doesn't limit itself to rectangular design. A round cross section worked out better here, for example, at the first planned gas-steam turbine station ever designed and built in United States.

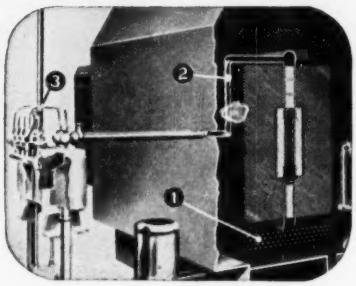
improves power generating efficiencies...



Triple Lane tube layout, another design feature, provides 3 pathways for steam travel, utilizes maximum cooling surface and produces higher condenser vacuums for power generating stations.

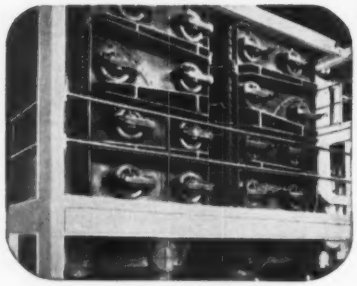


Location of air-vapor takeoff speeds steam travel and allows steam to penetrate to the peripheries of all tubes. It thus improves condenser efficiencies and overall power station operation as well.

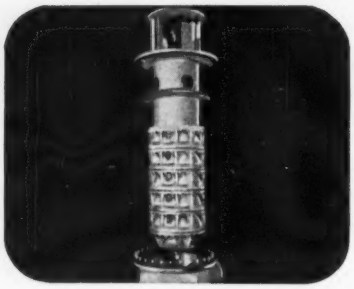


Deaeration of condensate not to exceed 0.01 cc. oxygen/liter is available with special Wheeler designs. Note the Deaerating Bars (1), the Air-Vapor Suction Line (2), and Tubejet® Ejectors (3).

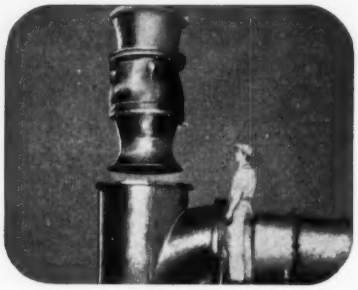
and reduces maintenance



Patented Reverse Flow permits flushing tubes and sheets without shutting down Unit, during full load with either or both circulating pumps operating. No additional circulating water inlet or discharge piping necessary with C.H. Wheeler's Reverse Flow.



"Pull-Out" Condensate Pumps simplify maintenance because entire pumping element, including all rotating parts, can be removed without disturbing either the pump barrel or the piping connections.



C. H. Wheeler Circulating Pumps, like Condensate Pumps, are easy to inspect and maintain because of "Pull-Out" design. In addition, shafts are heat treated alloy steel and impellers are statically and dynamically balanced for trouble-free operation.

C. H. Wheeler has been designing and building condensers since 1903; has developed such features as Dual Bank Design and Reverse Flow.

C. H. WHEELER MFG. CO.

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Whenever you see the name C. H. Wheeler on a product, you know it's a quality product

Steam Condensers • Steam Jet Vacuum Equipment • Centrifugal, Axial and Mixed Flow Pumps • Marine Auxiliary Machinery • Nuclear Products

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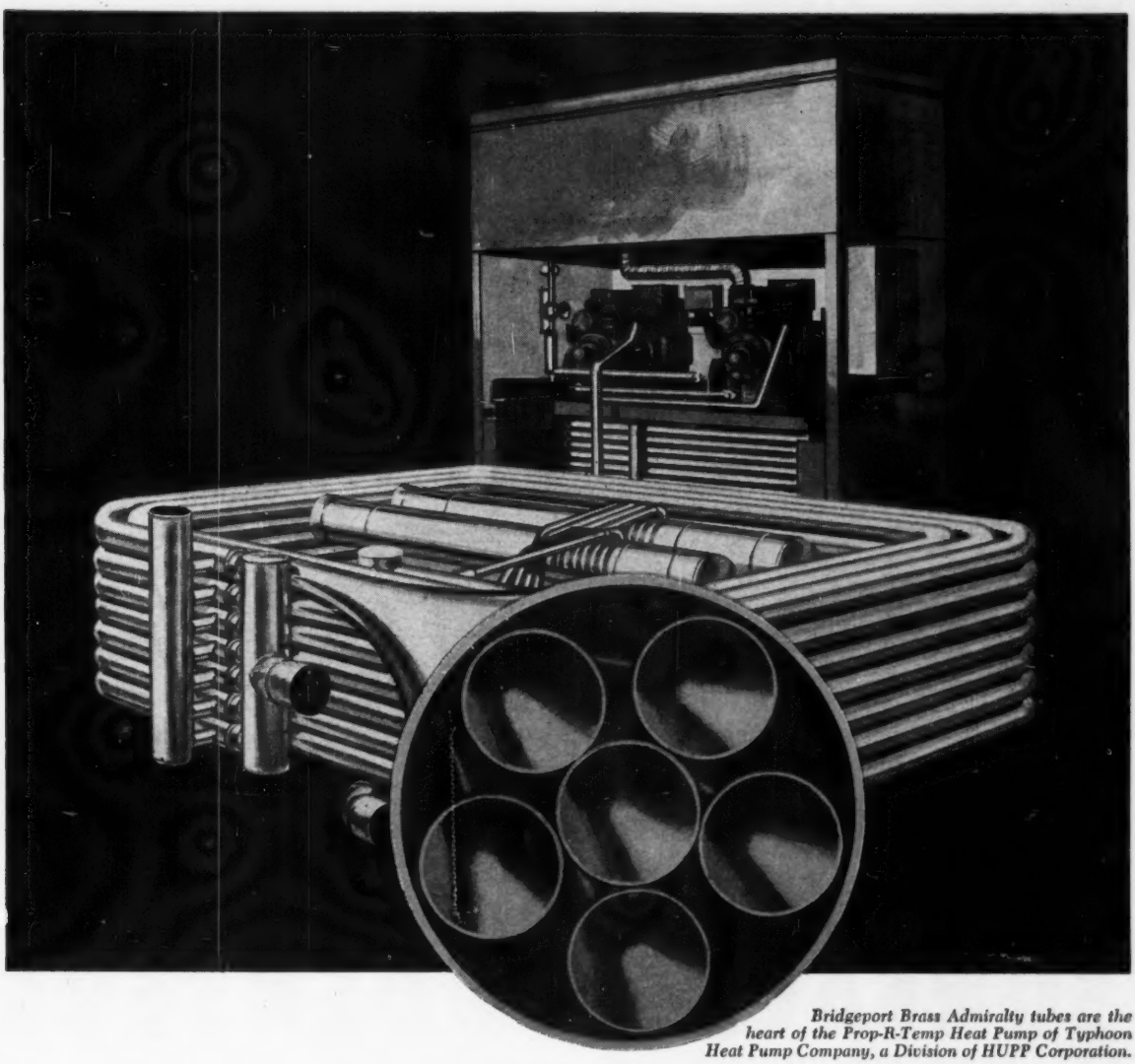

Bridgeport Brass Admiralty tubes are the heart of the Prop-R-Temp Heat Pump of Typhoon Heat Pump Company, a Division of HUPP Corporation.

1,000 HEAT PUMPS PROVE THE DEPENDABILITY OF BRIDGEPORT TUBES

This remarkable Prop-R-Temp Heat Pump, a product of Typhoon Heat Pump Company , Tampa, Florida, heats, cools and dehumidifies. A key part of this unit is the tube-in-tube condenser coil which transfers heat from water to refrigerant, or reverse. This unique circular or rectangular coil consists of six ⅜" O D Bridgeport Admiralty tubes nestled inside a larger, 1⅜" O D Admiralty tube. The six smaller tubes are inserted into a straight length of larger tube and then coiled or bent on blocks of various radii. This fabricating method requires closely controlled physical properties of tube to avoid distortion. The length and number of coils—whatever their size—is subjected to a test of 1,000 lbs. pressure before being accepted for application.

Years ago, trouble was frequently experienced due to copper tube failure or excessive scaling caused by highly corrosive waters in certain localities. This failure was costly since,when it occurred, it was necessary to replace the entire condenser.

Bridgeport came up with the answer—Admiralty tubes. Since the switch, over 1,000 Typhoon heat pumps have gone into service without one instance of tube failure due to corrosion in sizes varying up to 1,000,000 BTU's.

Here again is an example of how *standard* Bridgeport alloys overcame *special* fabricating and corrosion problems. It's also an example of why it pays to take advantage of Bridgeport's outstanding metals know-how. Call in the Man from Bridgeport, today. There's a Sales Office near you. Or write to Dept. 5411.

BRIDGEPORT BRASS COMPANY

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Specialists in Metals from **Aluminum** *to* **Zirconium**

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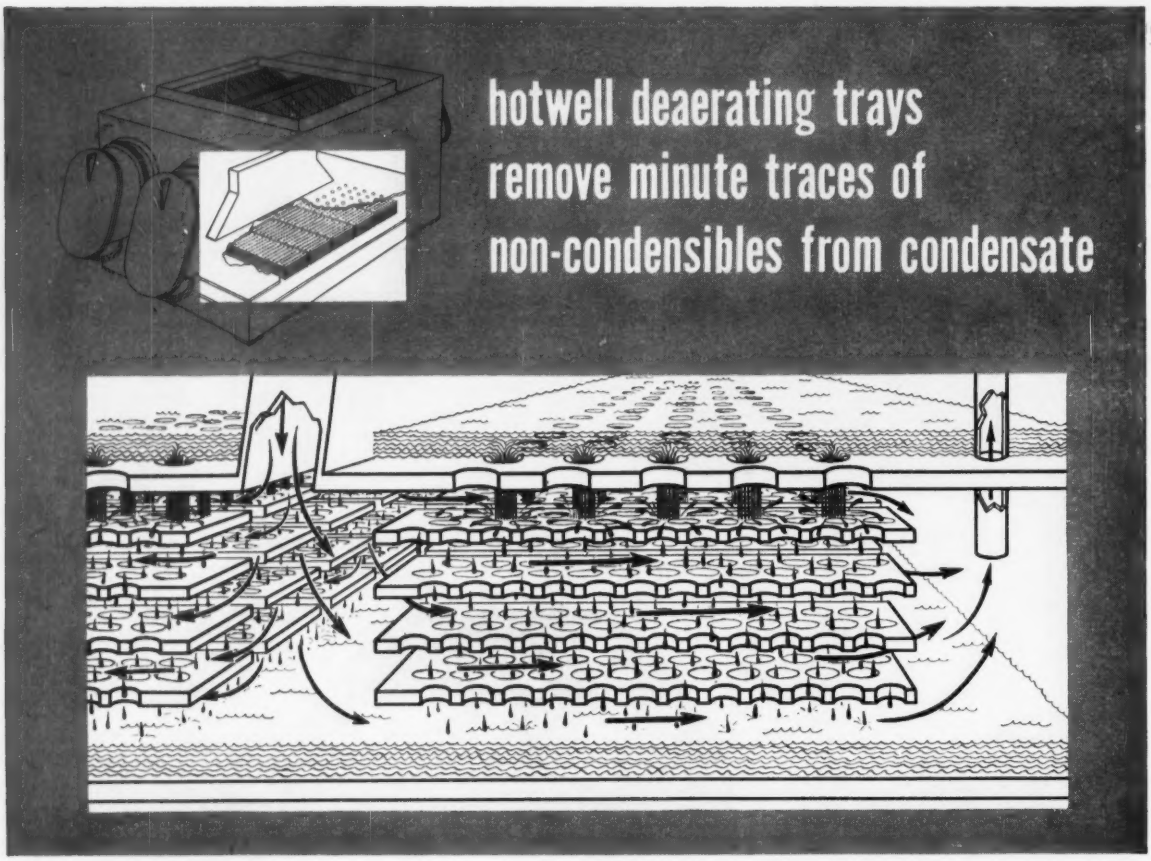

another factor in the marked superiority of **AMERICAN-Standard**

SURFACE CONDENSERS

Highly significant features, many of them exclusive, mark the superiority of American-Standard* Surface Condensers (formerly products of Ross Heat Exchanger Division).

The role of the hotwell deaeration trays is indicative, for they carry out the all-important function of removing the last, minute traces of non-condensibles from the condensate.

Starting at the first deck of the condenser, the condensate is divided into hundreds of small streams which first splash on the top deaerating trays, then successively splash down through the other trays in the stack. By the time the condensate reaches the bottom tray it has been separated into thousands of fine droplets, presenting an extremely large aggregate of liberating surfaces in contact with live, pressurized steam (at saturation temperature) introduced through the steam scoop. This results in condensate oxygen concentrations of .01 cc per liter or less and is obtained at no appreciable premium in space or cost.

The painstaking engineering, breadth of experience and specialized facilities invested in American-Standard Surface Condensers are without equal. A point-by-point discussion with an American-Standard Condenser sales engineer will leave you convinced. Meanwhile, make sure you write for a copy of Bulletin 8.2K1.

American-Standard Industrial Division, Detroit 32, Michigan. In Canada: American-Standard Products (Canada) Limited, Toronto 4, Ont.

*American-Standard and Standard ® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
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AMERICAN BLOWER PRODUCTS • KEWANEE PRODUCTS • ROSS PRODUCTS

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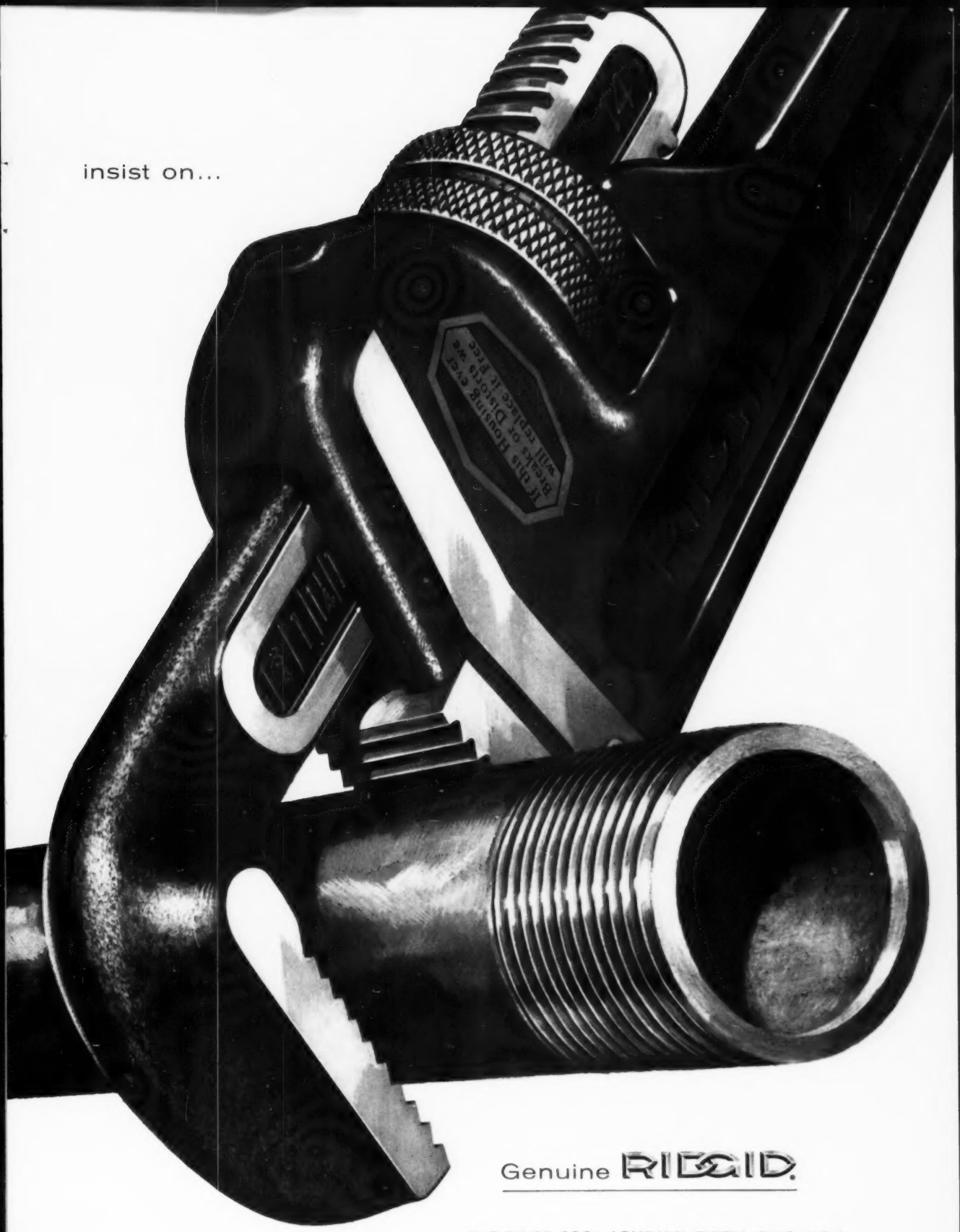
circle 237 on Reader Service card, p 101 ➤

insist on...



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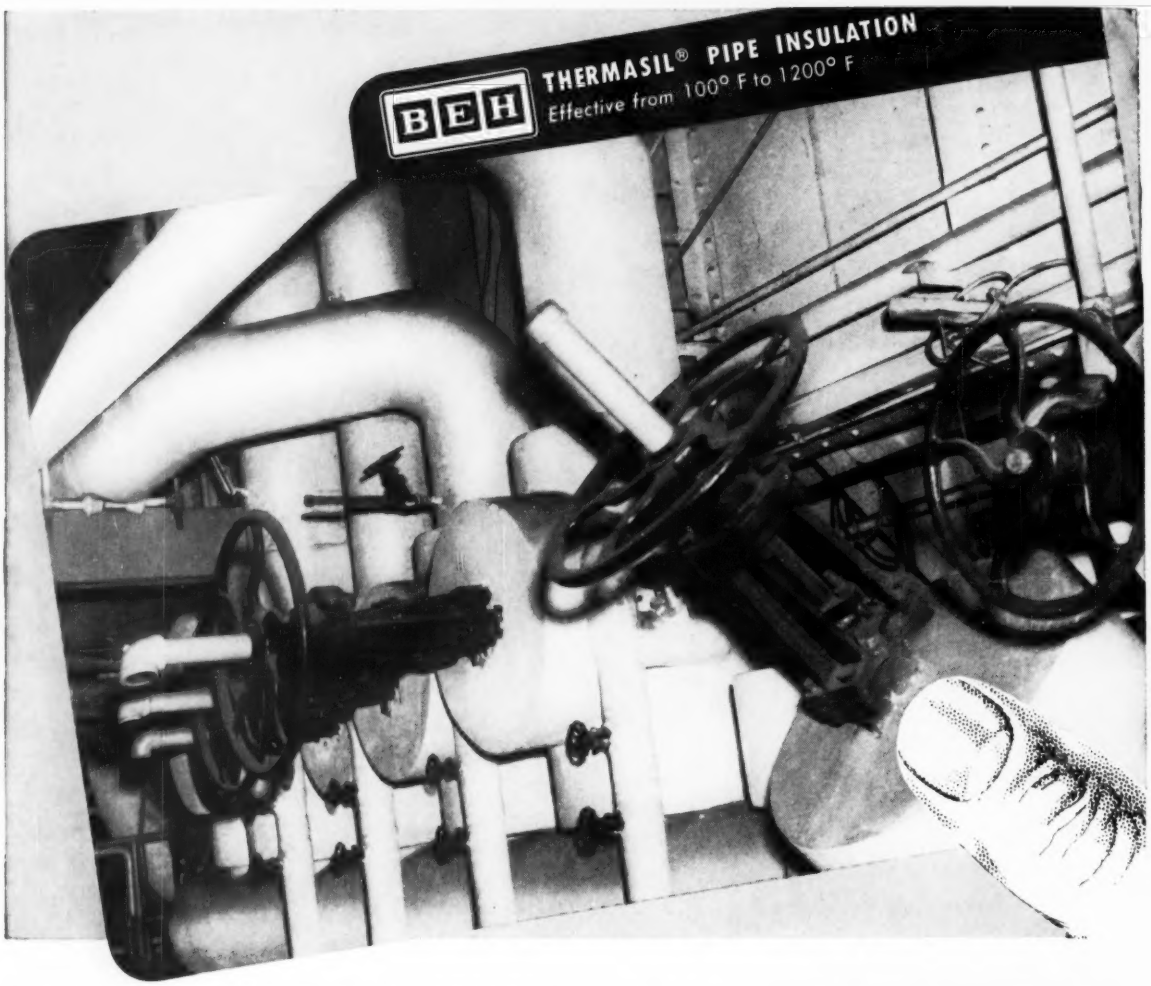

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They certainly are saving money — and you will too — with B-E-H THERMASIL calcium silicate in application, low maintenance and long service life. It is molded — not machined — to exact finished sizes. This assures that both inside and outside surfaces are tough, smooth and dust-free with dimensions held to close tolerances, providing a tight, uniform fit. THERMASIL is exceptionally light in weight, permitting easy and fast application; is readily cut, sawed, scored, drilled with standard tools — no special fabricating equipment required. It is unaffected by water or weather; has high structural strength — good for the life of the equipment it insulates. For information on B-E-H THERMASIL and other dependable B-E-H Insulations, write for catalog. Contract application service available coast to coast.

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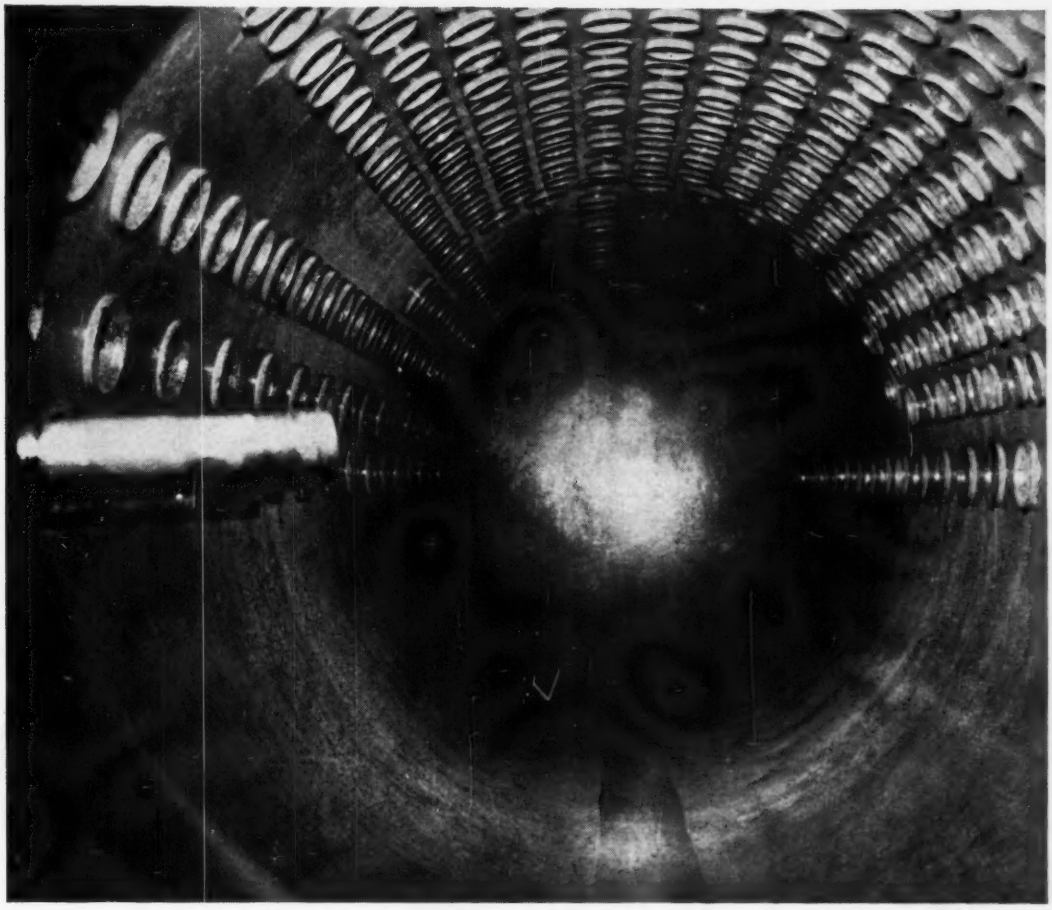

No Sludge . . . No Scale . . . No Corrosion in this boiler

Opened for inspection, this large boiler drum shows the results of a year's attention to good water treatment: *nothing!* No sludge, no scale, no corrosion . . . Ready to go back on line without even a wash-out . . . Down time and maintenance minimum, fuel economy and operating efficiency tops . . . Thanks to The Nalco System of Water Treatment, and good plant control practices.

Nalco System treatment includes proper water treating chemicals *plus continuing Nalco service* that assures effective protection for your steam and water system—from raw water intake through condensate return lines.

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NALCO CHEMICAL COMPANY

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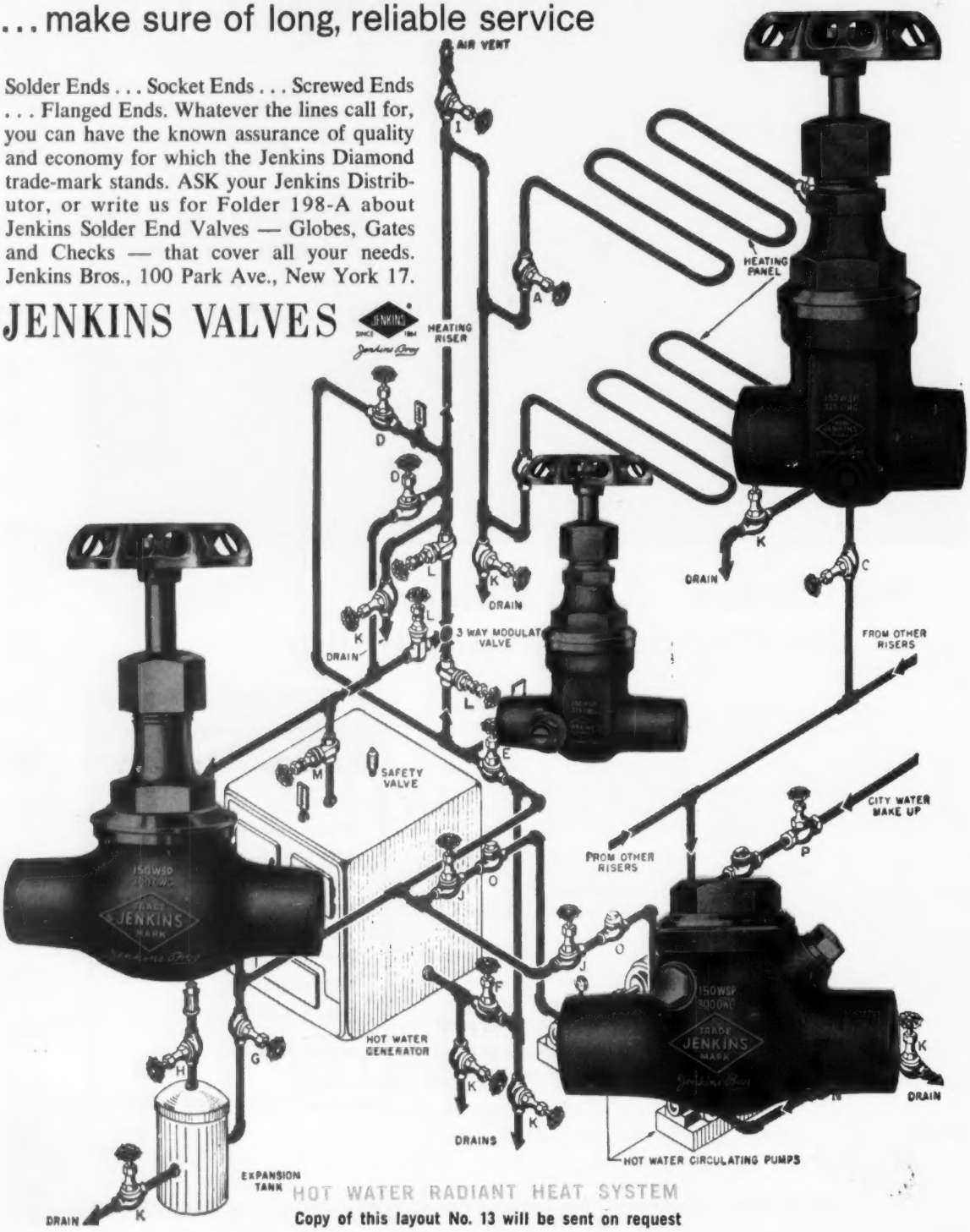


HOT WATER RADIANT HEAT SYSTEM

Copy of this layout No. 13 will be sent on request

For more facts circle 240 on Reader Service card, p 101

LOUIS N ROWLEY, EDITOR • NOVEMBER 1959 • ESTABLISHED 1882 Power

Trends worth watching

One of the quiet, but real, pleasures that come to an editor is the opportunity to watch the evolution of trends that he has recognized as significant and perhaps has played a part in furthering. A triple-barreled example of this came my way recently, after Jim O'Connor and Norm Peach returned from a General Electric press preview.

At the preview, the manufacturer had unveiled an expanded line of "preferred design" transformers. As the name implies, these units carry the price and delivery advantages of standardized equipment into the range of capacities above 12,000 kva. But another feature was of particular importance—provision for economical capacity increase as future needs might dictate.

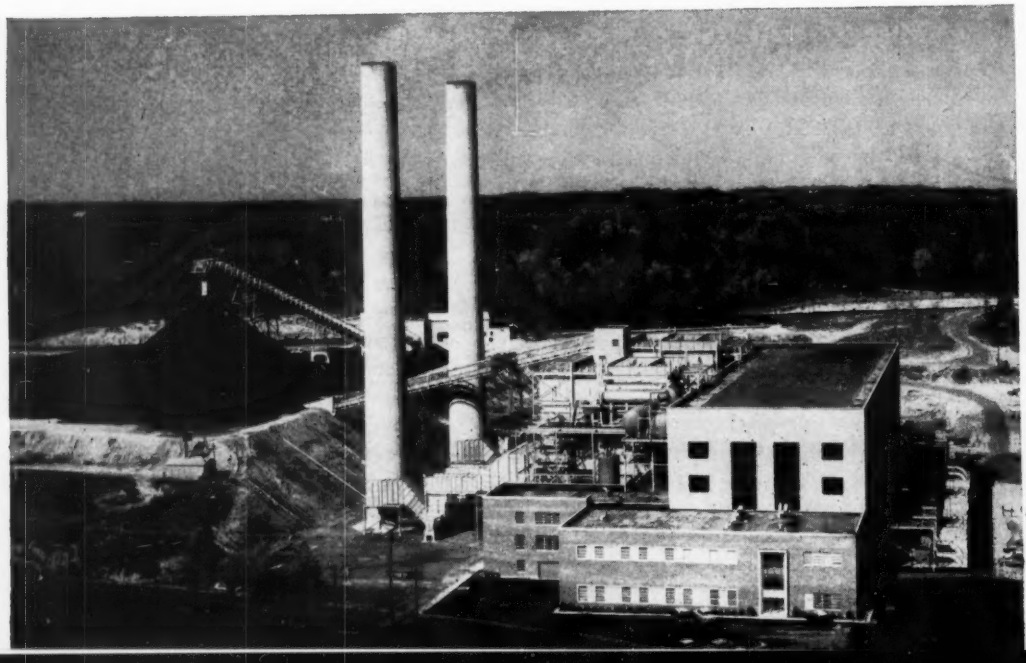
When a customer buys one of these units—say a 12,000-kva design—he gets a basic self-cooled transformer. When load growth calls for more capacity, he can add standard fan units for forced-air cooling. This brings capacity up to 16,000 kva. If load continues to grow, as it surely will for most industrial and utility systems, a further simple modification adds 4000 kva to bring the total to 20,000. This last step involves removing a U-bend connection and replacing it with an oil pump that fits the same bolt holes. The resulting forced circulation yields the further capacity increase to the 20,000-kva figure.

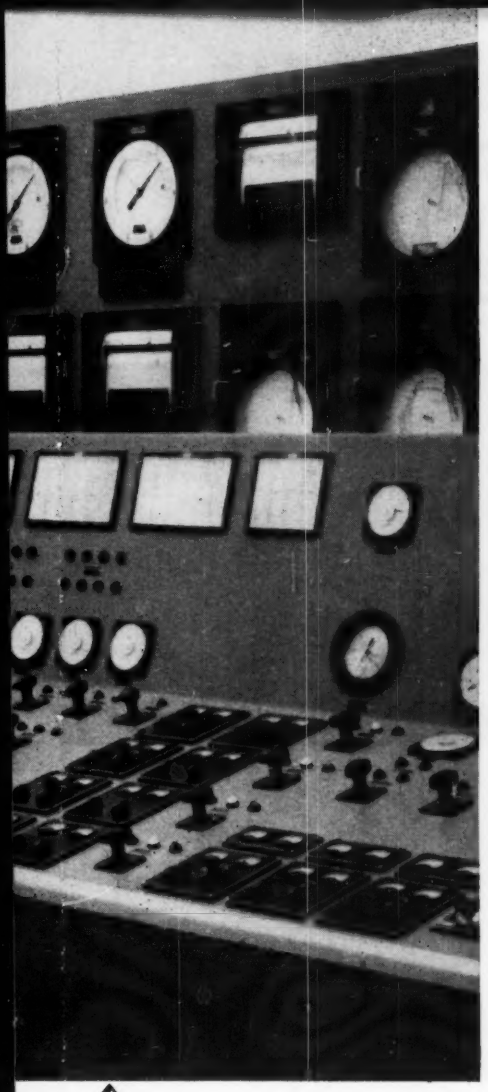
This general idea of triple ratings for transformers isn't new, of course. It has been well known for some years in smaller units. Now the scheme is extended to large power transformers. This development might once have been considered of interest almost solely to utility engineers, but today it holds interest for a growing number of industrial power-service men, as well.

Here we have the result of a trend we editors have been watching for some years—the increasing proportion of primary substations that are owned by industry. As this trend to self-ownership continues, more and more industrial electrical engineers will be concerned with selecting transformers for relatively high voltages and capacities, and with integrating them into economical and expansible substation designs.

Another trend we have watched—and fostered editorially—is the swing to standardized designs. This has made most headway in the electrical field but is demonstrating its values in other power-service areas as well. Some of these values are generally lower prices for standardized products, savings in engineering time and expense for both customer and supplier, and speedier delivery.

Finally, this press preview reminded me (as if I needed reminding!) of the ever-increasing importance of the "Power to grow" philosophy and the increasing extent to which it is being applied, not only in design of industrial electrical systems, but in the design of equipment for these systems. Facing, as we do in the 60's, a period of strong industrial growth and expansion, we must bring to bear on this challenge every engineering resource available to us. Only if we possess the Power to grow . . . *economically*, can we expect to realize for ourselves and our companies maximum benefit from the real opportunities that lie ahead.





CENTRAL CONTROL ROOM

Located in control consoles are the vital Republic electronic combustion, feedwater, and temperature controls that monitor and regulate boiler system.

SILAS C. MCMEEKIN STATION

When operating at capacity, this new station can provide 2,409,000,000 kwh annually for the customers of South Carolina Electric and Gas Company.

Republic Electronic System Controls New McMeekin Station

At the new Silas C. McMeekin Station of South Carolina Electric and Gas Company two 910,000 lb/hr boiler systems are operating under all load conditions at maximum efficiency with the help of Republic Flow Meters Co. electronic combustion and feedwater control.

From the central control room—nerve center of the power plant—Republic electronic equipment in two master consoles provides continuous data and control for feed pump, feedwater, combustion, and superheat and reheat temperature. Important measurements of temperature, pressure, and flow are fed into an automatic data logging system and are recorded hourly. This complete control package was engineered by Republic working with Gilbert Associates, Consulting Engineers of Reading, Pa.

The Silas C. McMeekin Station is another example of Republic Flow Meters combustion control system engineering service at work. Republic's engineering experience in plants of all sizes, all pressure and temperature ratings and all load characteristics is your best guarantee of premium equipment performance. A technically-trained, thoroughly experienced Republic Sales Engineer is ready to discuss your instrument and control problems. Contact your nearest Republic representative, or write Republic Flow Meters Company, 2240 Diversey Parkway, Chicago 47, Illinois. In Canada: Republic Flow Meters Canada, Ltd., Toronto. Subsidiary of Rockwell Manufacturing Company.

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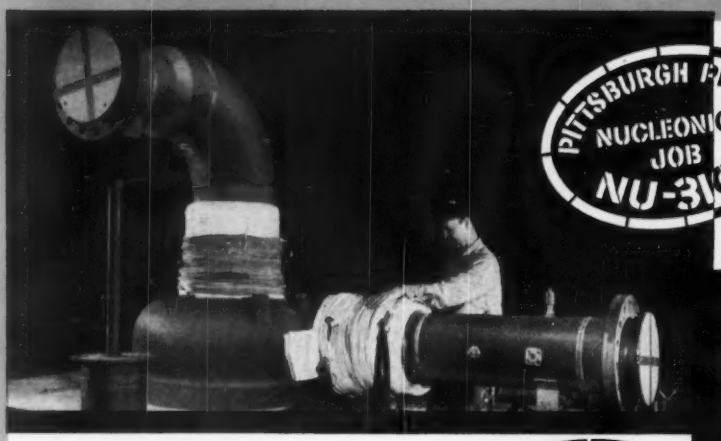
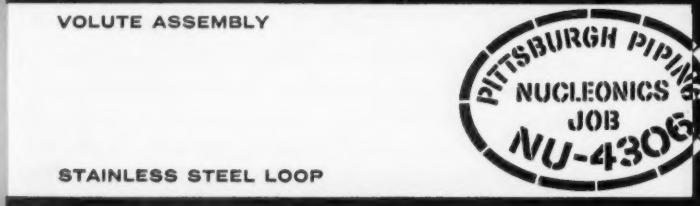
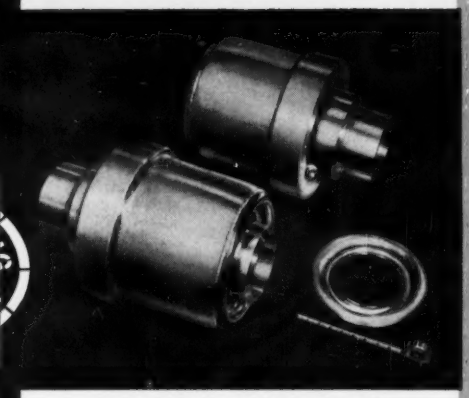


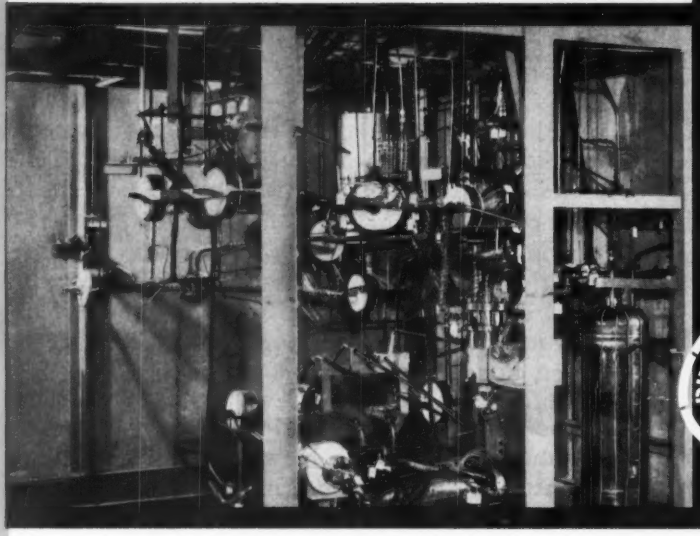
VOLUTE ASSEMBLY



STAINLESS STEEL LOOP



BULKHEAD PENETRATOR



Fabricated by Pittsburgh Piping for Nucleonics

These jobs demonstrate the variety of nucleonic piping work done in our shops. The volute assembly, shown in intermediate stage of manufacture, is fabricated of 14" and 16" Schedule 160 piping materials. The bulkhead penetrator, one of a group, is notable for an unusual method of welding dissimilar metals. The complex test loop requires skillful welding of stainless steel piping materials, and precise assembly of hundreds of components. We are equipped and staffed to do similar jobs for you. Telephone, or write and our representative will call. Or, we will be glad to have you visit our plant.

PIONEER FABRICATOR OF HIGH PRESSURE PIPING FOR NUCLEONICS

Pittsburgh Piping AND EQUIPMENT COMPANY
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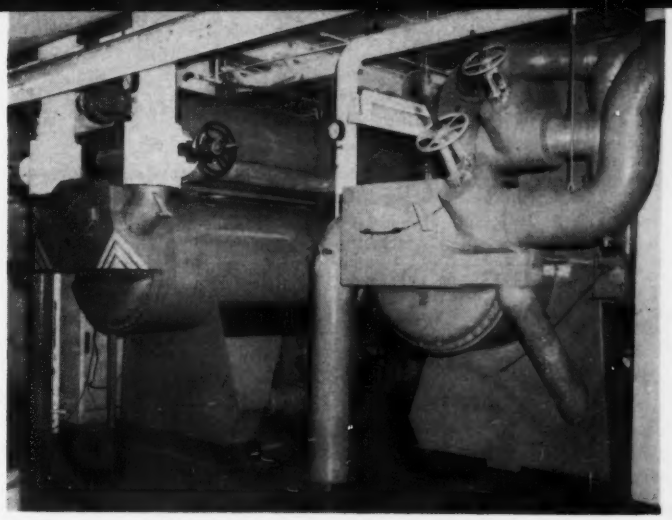
Atlanta....Whitehead Building Cleveland...Public Square Building New York..Woolworth Building
Chicago..Peoples Gas Building New Orleans.....P. O. Box 74

PP-40

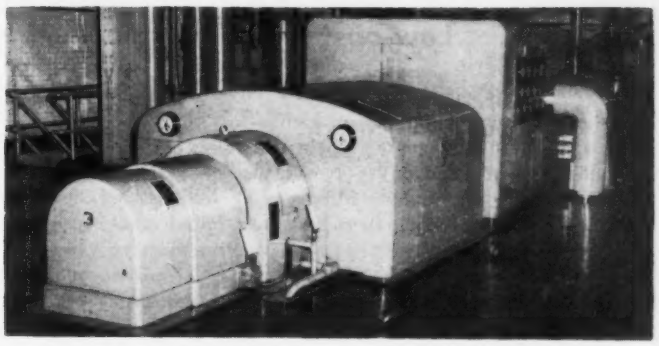
For more facts circle 242 on Reader Service card, p 101

Design and equipment application section

B G A SKROTZKI
Associate Editor in Charge



Absorption-refrigeration system plus...



byproduct power give Parke, Davis a...

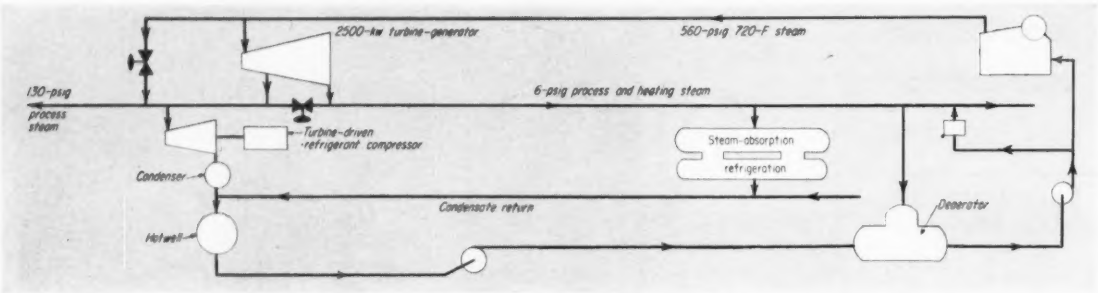
Cost-cutting power-services team

By L A PLATH, Consulting Engineer
Parke, Davis & Company, Detroit, Mich.

Selection of air-conditioning and refrigeration equipment can represent an important economic decision for industrial plants. Since no single type of air-conditioning installation is best for all areas and plant conditions, plant engineers must plan carefully to get the most for their air-conditioning dollar. This requires study to clearly establish operational and economic compatibility between refrigeration equipment and existing plant facilities.

If your plant is in line for air conditioning and also has special process needs, experience at Parke, Davis & Company's Detroit plant may show the way to cut net cost of air conditioning to the bone. Careful integration of refrigerating equipment into heat cycle boosted in-plant electrical generation during summer months and saved over $26,000 a year when compared to alternate cooling methods.

Parke, Davis, one of the world's largest and oldest drug manufacturers, was confronted with a 1955 engineering forecast which indicated expansion of air-conditioning load for their Detroit plant of at least 1600 tons in the succeeding three years. As a pioneer in the use of air conditioning for process (since 1906), they recognized the importance of selecting a basic type of refrigeration providing optimum overall economy and a good operational marriage with existing production and power installations. **continued**



PLANT CYCLE indicates multiple-level steam requirements typical of many industrial power plants. Byproduct-power cycle allows efficient breakdown of temperature and pressure for process uses. Absorption-refrigeration units boost the turbine loading

Low-cost byproduct power became the key to system choice

Preliminary considerations involving location, unit sizes, application and cost estimates narrowed refrigeration-equipment selection to two choices: (1) centrifugal compressors—motor driven (2) absorption machines—steam actuated. In making our initial comparisons we found that electrically driven compressors possessed a high performance ratio. They required less cooling water for compressor - system condenser, meant lower piping costs and no need for increase in steam output, auxiliary boiler power or water treatment for boiler feed.

Absorption installation introduced minimum vibration in surrounding structures, and low electric-power requirements meant no additional primary switchgear, cable, or transformers necessary. Absorption refrigeration permitted "valley usage" of existing steam capacity during summer months with resultant increased generation of byproduct electricity. Local codes didn't require operator attendance because of low operating pressure. Also, with existing steam-distribution system, installation costs for absorption equipment were 18% less than for centrifugal compressors.

Existing equipment included steam generators for process and heating load and refrigerant compressor for process cooling. At the time, the Parke, Davis plant was supplied with condensing water for process air conditioning through an intake system from the Detroit river. Screens, strainers and necessary pumps were located in the power plant. (Capacity was adequate for any type of refrigeration.) This water, carrying heat from interior spaces and process operations, was discharged through a private sewer system to the river downstream from water intake.

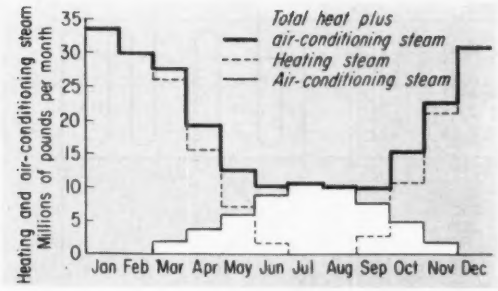
Total operating capacity for all boilers, 230,000 lb per hr—almost double peak winter load for heating and process—could more than meet any absorption-refrigeration requirements in this latitude. The powerhouse installation also included superheater and steam-driven auxiliaries operating at 560 psig and 720 F; maximum plant process-steam condition of 130 psig was accommodated by extraction steam and reducing valve.

In June 1956, Parke, Davis put into operation a single 2500-kw ac noncondensing turbine-generator for exhaust into 5-psig steam system and automatic extraction at 130 psig into existing process-steam system. An 80,000 lb-per-hr boiler was converted to operate at 600 psig and 720 F with maximum throttle flow of 72,000 lb per hr, maximum extraction flow of 60,000 lb per hr, maximum exhaust of 43,000 lb per hr. Turbine-generator operated in parallel with utility lines which were primarily for standby and purchased power. Turbine-generator output was limited to 2000 kw during summer months when exhaust steam couldn't be used for plant heating, balance of power was purchased. Prior to June 1956, 100% of power was purchased. Since self-generation began only 20 to 25% of power was purchased, for a net annual saving of $188,000.

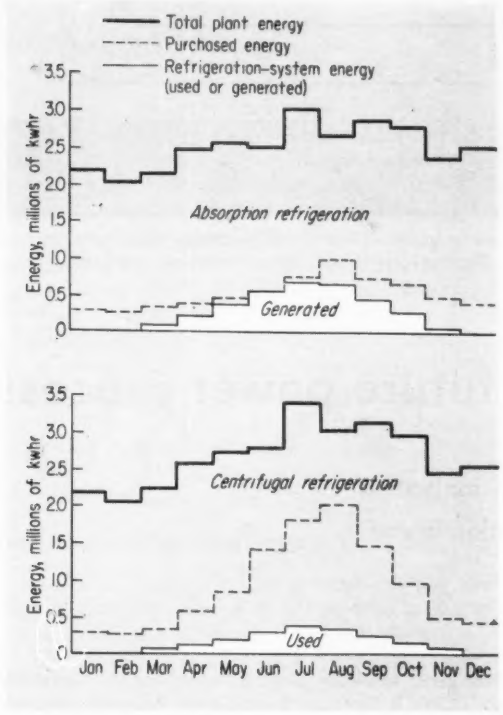
Electrical-distribution system and power supply were adequate for existing loads, but additional requirements imposed by motor-driven refrigeration would require an additional cable, accompanying switch-house alteration.

Cost estimates for preliminary calculations were based on out-of-pocket expense for both types of refrigeration. Steam-absorption equipment would result in incremental fuel costs while electrical refrigeration meant an increase in the annual energy bill from the public utility. But more important, cost of electric refrigeration would be extra since absorption refrigeration could operate on available steam at little additional cost. Because output of the turbine-generator is a function of existing steam load, it became even more economical to utilize existing steam-generating facilities than to introduce new electrical equipment with its accompanying owning and operating charges.

To substantiate our assumptions we established a cost comparison between absorption and electric refrigeration using 1030-tons refrigeration capacity (operating at 80% full load) as a base. We found that absorption refrigeration would consume 84% of full-load steam; the electric installation would use 75% of full-load power. We determined incremental fuel costs of exhaust steam for absorption would be 38c per 1000 lb, and generated-energy cost would be 0.145c per kwhr. Purchased energy, including demand, would cost 1.15c per kwhr.



STEAM LOAD for heating and refrigeration affects by-product-power generation. White area is absorption cooling



ENERGY COMPARISON for absorption, electrical refrigeration shows lower, steadier load resulting from steam use

Absorption-refrigeration system cost estimates were based on exhaust-steam consumption of 17,300 lb per hr (84% of absorption-system full load). Increased turbine steam flow required to supply this load produced 1282 kwhr. Refrigeration auxiliaries used 138 kwhr, so net increase in energy was 1144 kwhr. The fuel cost to generate electric energy and supply exhaust steam was $8.43 per hr, which represented the relative operating cost of absorption refrigeration.

Centrifugal-refrigeration system consumed 632 kwhr for compressors and condenser pump power. In addition, loss of 1144 kwhr not generated by the plant meant an overall increase in purchased energy of 1776 kwhr. The hourly cost of centrifugal system totaled $20.42.

Cost differential between the two systems indicated hourly savings of $11.99 for absorption refrigeration. On the basis of 2000-hr operation yearly, annual savings of $23,980 could be anticipated. Since first cost and operating cost favored absorption refrigeration, Parke, Davis selected steam-absorption equipment, and in cooperation with Carrier Corporation planned installation of several machines.

We estimated that the substantial cost difference would be made possible by use of steam for air conditioning as heating demand declined. In practice, air conditioning has been required 24 hours a day from March through November. Generator output was never curtailed during summer months of 1958.

Operating costs. Bearing in mind the preliminary calculation made before absorption system was installed it is interesting to note the actual cost of operation experienced. Only two "full operating years," 1957 and 1958, have ensued since installation, both years showing essentially the same pattern. Consequently we've selected the most recent 12-month period, Jan through Dec, 1958, for illustration.

Analysis of steam consumption for absorption refrigeration indicated that each month could be broken in half-month periods of *average maximum* and *average minimum* steam flow without serious error. Percent of full-load capacity was determined for these periods along with corresponding power required for electrical refrigeration. This method was found to be more accurate than using average values for the month. Auxiliary power for steam absorption—power for pumps, and an allowance for incremental boiler-feed pump output —was treated as a reduction of generation as shown in preliminary calculations.

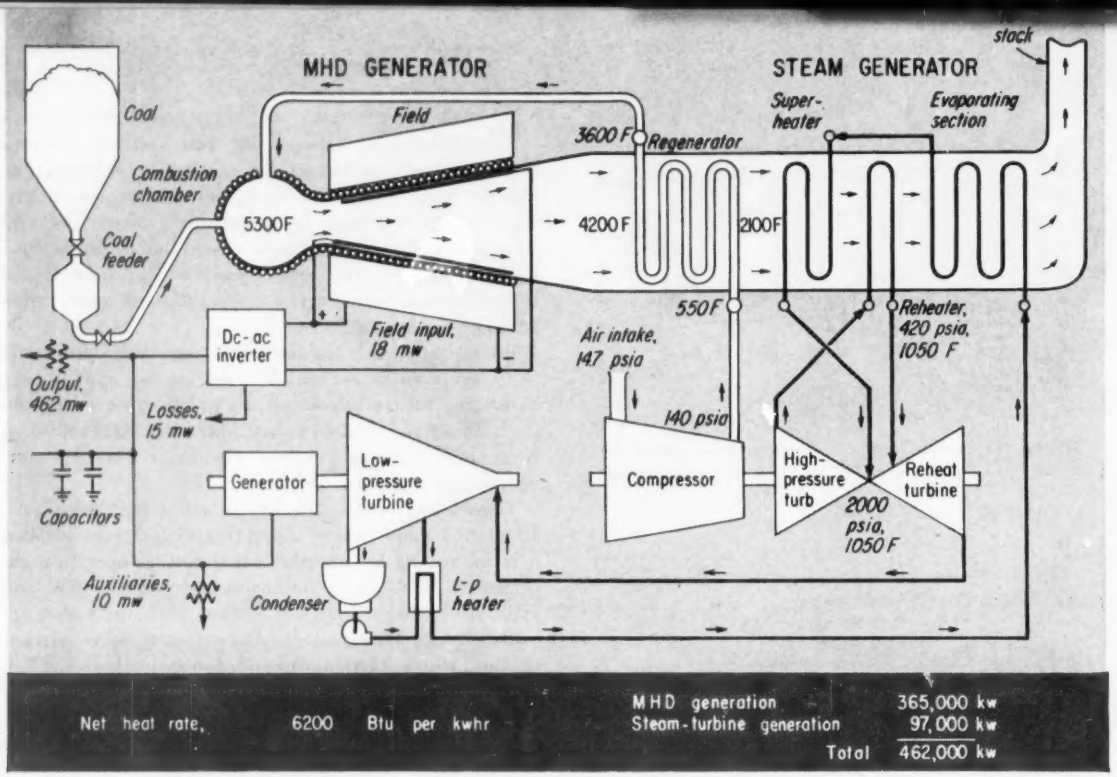
Consumption charts, left, indicate the magnitude of savings produced by use of absorption refrigeration. L-p steam use, above, during "valley months" of summer dropped to about 25,000 lb per hr as turbine exhaust dwindled. Absorption-refrigeration steam load, white area, represents available steam for generation.

Energy chart, middle plot, for absorption-refrigeration installation indicates the relatively stabilized electrical load. White area represents total power generated by increased steam flow for absorption system.

Electrical-refrigeration costs for the same period were estimated on the basis of equal cooling load. Auxiliary power for compression-refrigeration system consisted of incremental power required by present river-water pumps with due allowance for decreased condenser-water flow required with electric-refrigeration machines.

Energy chart at bottom shows summer peak of purchased power. In this case, white area represents power used by refrigeration. Net loss would be the sum of the white areas for absorption and centrifugal refrigeration.

Net savings for actual operation of absorption refrigeration ran to more than $26,000 per year. The addition of 575 tons this year is expected to increase this savings, but at a decreasing rate. Parke, Davis is currently building a new research center at Ann Arbor, Mich., which will incorporate three 700-ton absorption machines for comfort and process. Byproduct generation of power is expected to be augmented here also by installation of absorption-refrigeration equipment.



PROPOSED POWER-PLANT CYCLE burns coal in h-p air. Combustion gases seeded with metal vapor flow through MHD generator to produce 360-mw dc electricity, pass on to regenerator, superheaters, boiler. Latter equipment feeds steam turbines

Magnetohydrodynamics—future power process?

Extra-high combustion temperatures leading to ionization may allow us to use new-found scientific information in converting heat directly to electricity

By PHILIP SPORN, President, American Electric Power Service Corporation
and ARTHUR KANTROWITZ, Director, Avco-Everett Research Laboratory

It is widely recognized that in the world of today, scientifically and technologically speaking, things are going much faster, they are moving on a different kind of track and under a different propulsive system than they did only a decade or so ago.

The existence of, and accretions to, the common reservoir of basic scientific knowledge and technological skills and resources also have a way of wonderfully rekindling previously abandoned potentialities for successful development of old concepts, or of making possible new and exciting routes for exploitation of concepts having a history of successful development along less daring lines. Illustrative of that we have three examples in the following discussion from the field of power.

Atomic energy. Atomic fission burst upon the world's consciousness about 14 years ago with the explosion of the first atomic bomb over Hiroshima. This had much greater potentialities for peaceful exploitation as a new energy source in the service of man, however, than as a weapon of destruction. If atomic energy has not yet reached any point of significant, major contribution to the world's energy resources, its likely future contributions are more clearly understood and appreciated.

In all the work of developing potentialities of nuclear energy, we almost always postulate generation of steam to drive a steam turbine; the turbine supplies mechanical power to a revolving field forming the moving part of an electric generator. This

continues the reign of the steam engine started by Watt 125 years ago. In practically all nuclear-power reactors developed so far we continue to use the basic heat engine patented by Watt in 1769.

In the past 12 months, however, doors have opened on three avenues that may lead to advances in energy conversion and may affect energy generation of the future (of the next 100 years or so) with possibly greater significance than atomic fission. These are developments in: (1) thermionic generation (2) thermoelectric generation and (3) exploitation of the magnetohydrodynamic (MHD) principle for generating electric energy. While these highly intriguing prospects depend on different principles, they have this important fact in common: All three offer prospects of direct conversion of heat energy into electric energy.

Thermionic emission

Thermionic emission is the phenomenon of electron emission from the surface of an electron-conducting material owing to thermal energy of the electrons within the material. This phenomenon was first observed by Edison (*Edison effect*) and later, in 1901, fully described by Richardson.

New developments along two lines have been reported in the past year for the direct conversion of heat to electricity by this means. Work at Los Alamos Laboratory culminated in the design of a cesium-filled thermionic converter which operated in a reactor and produced about 40 watts (POWER, Oct 1959, p 176). Similar work has been carried out with high vacuum, close-spaced diodes producing outputs of several watts using various heat sources, one being the concentrated rays of the sun (POWER, February 1959, p 59).

Thermoelectric generation

The basic discovery or invention of thermoelectric generation was made by Seebeck in 1820. By accident, Seebeck achieved thermal efficiencies with his thermocouple that were comparable with the then contemporary steam engine. But the long-range significance of his accomplishments could not be forecast; as steam engines improved in efficiency the thermocouple was relegated more and more to the background until it became nothing more significant than a temperature-measuring device.

A number of theoretical developments in solid-state physics and quantum mechanics and the development of devices like the semiconductor have now made it possible to think seriously of the thermocouple again as a basis for converting heat to electricity. And by supplying electric energy to a thermocouple we can produce either heating or cooling effects.

Magnetohydrodynamics

In magnetohydrodynamics (MHD) no such solid achievement has been realized as in thermionic generation; yet the possibilities for new developments in generation of electric energy are even more exciting. Faraday's discovery of electromagnetic induction brought to light the fundamental law that when a conductor and magnetic field move with respect to each other an electric voltage is induced in the conductor. Connecting a load, in the form of a motor, lamp or appliance, to the terminals of the conductor allows an electric current to flow through it.

Faraday's law does not tie down the conductor to any special form—a loop of copper wire, for example. The conductor could be a fluid—a gas or liquid. The idea of using such a fluid with a magnetic field constitutes the phenomenon of magnetohydrodynamics.

MHD concept is not new

Generating electric energy by the magnetohydrodynamic principle is not a new idea. Patents dealing with the idea of producing electric energy without moving parts by the motion of a conducting fluid (in one case, salt water) through a magnetic field are available and date back at least 50 years. But the various forms of the idea previously visualized never got very far because of inadequate understanding of the phenomenon involved. There was a lack of knowledge of the performance of gases at high temperature.

Recent work, however, in study of missile re-entry problems has developed a good theoretical understanding of the electrical conductivity characteristics of gases at high temperatures in ranges above those normally encountered in thermal-power plants. This new understanding has raised the question of whether or not a technically feasible and economically attractive plant for the large-scale generation of electric energy can be built using MHD principles.

For more than three years, operating under Air Force contract, the Avco-Everett Research Laboratory has been investigating the behavior of high-temperature gases in shock tubes and correlating the results with modern theoretical physics and aerodynamics.

This has led to re-examining various aspects of generating electric energy utilizing MHD concepts. Avco-Everett has proposed that electric energy could be generated by passing a high-temperature high-velocity gas stream through a strong magnetic field. To obtain adequate gas conductivity the machine must operate at high temperatures. These present handling problems but promise high thermal efficiencies in a device that acts like a gas turbine but is completely static and yields electric power directly. The breakthrough in the search for higher thermal efficiency of converting heat to electricity that this promises, offers opportunities for continuing profitable exploitation for the electric-power industry for a considerable time into the future.

To evaluate the potential gains and the problems inherent in a thermodynamic cycle using an MHD

Comparison of investment costs, conventional versus MHD generating units (preliminary)

Equipment	Conventional unit, $ per kw	MHD unit, $ per kw
1. Steam generator and accessories	31	10
2. Steam-turbine-generator and compressor drive	38	12
3. Air compressors	–	4
4. Regenerator	–	7
5. MHD generator	–	7
6. High-temperature valves, ductwork and combustion chamber	–	4
7. Electrical converters and accessories	–	33
8. Reactive supply	–	5
9. Piping, pumps, heaters and condensers	23	10
10. Building space for conversion equipment	–	2
Totals	$92	$94

generator, a 3-month study has recently been carried on jointly by the American Electric Power Service Corporation and the Avco-Everett Research Laboratory. The theory of the MHD generator performance is fairly well developed, but its practical design and accommodation in a power-plant cycle for large-scale power generation has not been previously studied.

The study described here indicated the potential performance of a coal-burning and nuclear-fueled MHD plant, as well as areas of development which would be required before such plants could be finally designed. A more detailed description of the coal-burning plant is given below.

Open-cycle coal-fired MHD plant

To obtain an estimate of the fuel and capital cost which might be needed by a coal-burning MHD plant a specific preliminary design has been made. An open cycle was chosen in preference to a closed cycle because of its greater simplicity. This selection reduces problems of multiple heat transfer even though leading to more difficult problems in the MHD generator and associated equipment by virtue of passing the products of combustion directly through the generator.

In making this preliminary design, knowledge and experience gained in studying the re-entry problem of intermediate-range and intercontinental ballistic missiles was the prime guide in putting quantitative values on such unknowns as disassociation at high temperatures, particularly of the coal combustion products, heat-transfer rates at these extremely high temperatures and the effect of additive seeding agents. All these factors must be checked by test before an actual plant layout could be designed or even before effective final design of cycle arrangement could be made.

Schematic on page 62 shows the preliminary coal-burning MHD cycle. The MHD generator is combined with a conventional reheat steam turbine to obtain a highly efficient cycle. The cycle performs like a combination steam turbine-gas turbine cycle in which the MHD generator takes the place of the high-temperature gas turbine.

By virtue of the high operating temperatures a low heat rate of about 6200 Btu per kwhr is indicated—a 25% improvement on the heat rate of the most efficient plants now projected. This would be subject to improvement as experience is gained with operation of this type of equipment.

MHD plant cycle features

The preliminary study work is by no means adequate to fully define the best operating conditions for peak efficiency, but the diagram shows reasonable values. Flow rates have been chosen to give a net plant output of about 450 mw. In practically all features the MHD generator is more attractive in larger sizes.

The cycle compresses atmospheric air to about 140 psia and heats it to 3600 F in a regenerative air heater. Coal combustion raises the gas to 5300 F. This high-temperature gas (its conductivity increased where necessary by "seeding," i.e., by adding a small amount of vaporized metal such as potassium) then passes through the MHD generator developing about 360-mw dc energy.

Hot exhaust gas from the MHD generator at 4200 F passes through the regenerative heaters, cools to 2100 F and then flows to the boiler. Steam generated in cooling gases from 2100 to 300 F drives a conventional steam turbine that supplies power for the compressor and generates an additional 107 mw of ac energy.

In this cycle the steam turbines, boiler, compressor, ac generator, feedwater heaters and their auxiliaries are essentially conventional equipment and represent no problem in development. The MHD equipment, however, represents special problems which would require research and development effort, particularly on the behavior of high-temperature gases in magnetic fields and on high-temperature materials.

MHD generation economics

It is much too early to prepare a reliable study of the economics of electrical-energy generation by an MHD generator. At the present writing an MHD generator designed and tested by Dr Richard Rosa of the Avco-Everett Research Laboratory has produced 10 kw of electrical energy (Reference: *Magnetohydrodynamic power generator*, R J Rosa,

Avco-Everett Research Report 69—to be published). Its performance, which approximates that calculated, is the fundamental basis for the design estimates given above, and for the rough economic estimates given below and in table, facing page.

Many of the fundamental principles need to be more thoroughly investigated and established. Yet a start has been made on sketching in the economic parameters. More particularly, since successful development of an MHD generator would displace certain heretofore indispensable items of cost in conventional plants, we can put together a table of costs that might be eliminated and new costs incurred. The MHD generator displaces heat-absorbing (as distinguished from heat releasing) parts of the boiler, such as steam generating, superheating and reheating, and also steam piping, steam turbine, turboalternator, steam condenser, boiler-feed pumps and a host of additional associated equipment.

The table, facing page, shows a preliminary comparison of major equipment that would be different for the two types of units.

These costs are mainly based on experience, with the exception in the case of the MHD unit of items 4, 5, 6 and 7. In a great many areas the MHD unit has great economic advantages over the conventional setup but it has a principal handicap in the fact that at the present time generation of direct current seems more feasible than the generation of alternating current. This requires for all practical applications the conversion of dc to ac. Generation at 2500 v and conversion by mercury-arc rectifiers would be perhaps the most practical means of converting the 365 mw of dc power, used as the basis of the table, along a heat-balance setup shown in the flow diagram.

It appears that this conversion can be done at a capital cost of $40 per kw and at an efficiency of approximately 96%.

When can an MHD plant be built?

This natural and intriguing question is premature and simply cannot be answered at the present time. At present we are nowhere near certainty that a plant like this can be brought into being, that is, that it is technically feasible; and while the economic prospects look promising, there is no way of telling whether the economic-feasibility test could be met if the technical feasibility for a MHD plant were established.

Formidable problems must be faced before a plant like this can be designed and operated. These consist mainly in understanding the stability of current paths in the gas, electrode effects, and other MHD phenomena. In addition, materials must be developed to handle gases at the very high temperatures—in the 3000- to 5000-F range—which would be encountered in a magnetohydrodynamic plant.

The preliminary investigations carried out in the 3-month study recently completed by American Electric Power Service Corporation and Avco-Everett Research Laboratory indicated that there is fair expectation that the theoretical and practical problems which must be faced can be solved. Before accepting this, however, it was felt that a program of work involving a number of stages to more fully explore this new concept in power generation ought to be carried out. Essentially this would consist of the following:

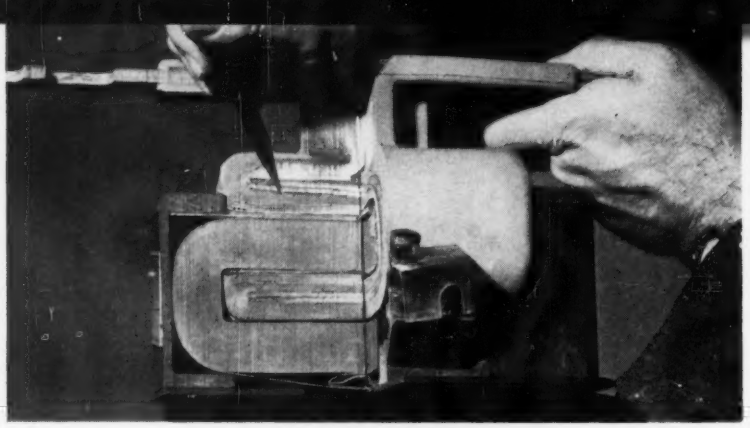
(1) A study of the basic principles of electrical energy generation by a hot conducting gas stream interacting with a magnetic field
   (a) Construction and operation of experimental generators
   (b) Theoretical study of generator types
(2) A search for and development of high-temperature materials suitable for use in an MHD generator and in the heat sources and heat exchangers associated with it
   (a) Tests of heat exchanger, liner and electrode materials
   (b) Design of heat exchanger and electrode configurations
(3) A study of electrical conductivity in gases
   (a) A search for superior seed materials
   (b) Refinement of present values for collision cross sections in gases of interest
(4) Engineering and economic studies of overall power-plant design

The completion of this program should determine the practical validity of the basic theory on which the MHD generator is based as well as develop generalized solutions for the critical materials problem. If this first stage were concluded satisfactorily, it might open the way to the projection of a smaller prototype plant which, in turn, would have to carry with it a research and development phase, the successful completion of which would lead to the building of a demonstration prototype plant.

It is obvious that all of this represents some highly intriguing and exciting prospects. Not only does it appear conceivable that an MHD power plant may be produced at a competitive cost, capital-wise, which will produce much higher thermal efficiencies (of the order of 60% as against the present best of 40%) than any existing power plant, but it would open up a wide avenue of prospects for future improvement. The fact that it makes use of a new and heretofore unexplored phase of a well-founded principle leaves open the hope that further developments or new ideas will be forthcoming, even though they cannot now be foreseen with certainty.

Because of this, a small group of ten electric-utility companies has been discussing sponsoring this research in a cooperative arrangement with Avco-Everett Research Laboratory.

By J F DEXTER
Dow Corning Corporation



CURRENT TRANSFORMERS are available with molded silicone rubber as major insulation

Exceptional thermal endurance, stability of electrical properties are reasons why, in spite of higher cost . . .

Silicone insulation tackles many jobs in today's electrical equipment

Within the past three or four years silicone insulation systems have been adopted for a wide variety of electrical-insulation applications. This follows more than a decade of severe service in traction motors, mill motors and dry type transformers.

Major advantage of silicones as electrical insulation is their outstanding thermal stability. Traditionally, temperature has been a limitation in design of electrical equipment. Size, weight and ratings of motors, transformers and cables are all dependent upon temperatures allowed by the insulation selected. But unique thermal endurance of the silicones virtually removes this limitation as a design factor. In many cases electrical performance and mechanical design limits are reached before temperature rise exceeds safe values for silicone materials, for example, the heat which can be dissipated by the rotor.

Advantages in addition to thermal stability are offered. Electrical properties of silicone resins and rubbers remain virtually constant over wide temperature ranges. Electric strength of one type of silicone-rubber coil insulation, for example, is the same at 200 C as it is at room temperature. Its dielectric losses and dielectric strength are unchanged by aging at high temperatures, and moisture and chemical resistance are outstanding.

Cost is the primary limitation of silicone insulation. In many instances, however, less-costly application techniques compensate for the higher materials cost. Silicone's higher thermal stability may make it possible to reduce iron and copper used in the equipment to further offset cost.

Two basically different types of silicone insulation systems are available today. One system depends upon silicone resins to bond fibrous glass, asbestos or mica combinations, replacing organic varnishes used in AIEE Class B systems.

Second system is based on silicone rubber developed specially for dielectric uses. Silicone rubber is usually applied to equipment conductors as unsupported or glass-cloth-reinforced tapes. These systems are usually molded and bonded to provide a waterproof, shock-resistant, sealed insulation jacket over the windings.

Insulation systems based on silicone resins provide exceptional thermal endurance; silicone-rubber systems give optimum protection from moisture and chemical contamination. Resinous systems are being used at the new AIEE insulation-classification temperature of 220 C; silicone rubber is restricted at present to Class H temperature of 180 C. Silicone insulation systems can be tailor-made to give apparatus increased life, reliability, service factor or reduced size and weight.

Motors insulated with silicone are available in all types and sizes ranging from fleapower servomotors to 6000-hp boiler-feed-pump drives. If designed temperature rise of a silicone-insulated motor is within Class B limits, silicone insulation system may provide a service factor as high as 30%. In a motor of this type, silicone insulation can withstand temperatures greater than the winding temperature developed when a motor is delivering maximum torque.

Motors can be selected to match actual starting, accelerating, full-load and overload torque and horsepower

requirements without concern for winding temperatures and insulation life. (Bearing temperature, lubrication, etc must be considered.) Usually the service factor of a silicone-insulated motor built to Class B temperature specifications will be limited only by such mechanical factors as bearing and shaft loads.

Typical drive requiring a high-service-factor motor is a forced-draft fan. Thus a 1000-hp, silicone-insulated motor can supply 1300-hp when starting against cold air. Starting as often as four times a day, such a motor provides a 30% service factor without sacrifice in life or reliability, yet operates at maximum efficiency at its rated full load.

Recent development of large motors insulated with silicone rubber has made possible less costly enclosures for motors in many applications. Because motor coils can be completely sealed in a moistureproof jacket of silicone rubber, open or dripproof motors can be used instead of totally enclosed machines. In addition, silicone rubber is resilient, so motors using silicone-rubber insulation systems will withstand severe mechanical shock and vibration. Since the layers of silicone rubber are bonded together into one homogeneous mass there is no possibility of tape separation.

Dry type transformers with silicone insulation are available in open or semi-closed styles and in sealed nitrogen-filled tanks. Sizes ranging from less than 1-kva control transformers to 3000-kva, 3-phase auxiliary-power and network units are available from most manufacturers.

Because of their thermal stability, silicone components bonded and impregnated with silicone resins are normally selected for dry type transformer construction. Since silicone resins have very low moisture absorption, and their electrical properties do not change appreciably when subjected to humid atmospheres, silicone-insulated transformers do not need special dry-out procedures. Ventilated dry type Class H transformers need not be kept energized; heaters aren't necessary to keep insulation dry when units are de-energized.

Open and semi-enclosed units provide high service factors. They are smaller and lighter than Class B transformers of the same rating. Not only are silicone-insulated transformers easier and less costly to install, but savings in iron and copper, within permissible power-loss limits, usually offset cost difference between silicone and Class B insulation. Trend toward aluminum conductors in dry type transformers may further influence price relationship between silicone and Class B insulated units. Sealed dry type transformers are economically feasible because silicone insulation allows inherently higher hottest-spot temperatures. This is recognized by the AIEE and NEMA in their Class H and Group III classifications which specify a 220-C hottest-spot temperature for this service.

If a silicone-insulated transformer is sealed in a nitrogen-filled tank maximum safety and freedom from maintenance are obtained. Silicone-insulated dry transformers often replace oil-insulated transformers requiring expensive vaults, fire-extinguishing apparatus or gas suppressors. Sometimes a silicone-insulated unit can be mounted near its load. Long, heavy low-voltage feeders are eliminated by using a high-voltage power service with silicone-insulated dry type transformer located at the load center.

Silicone rubber is also used by one manufacturer as the major insulation in current transformers. These molded units, above left, are smaller and have higher overload ratings than conventional current transformers. In addition they provide protection from extreme environments. Control transformers are similarly insulated.

Wire and cable can be insulated with silicone rubber to take advantage of low dielectric loss, thermal stability, outstanding corona resistance plus resistance to sunlight, moisture and weathering. It can be extruded onto the conductor or applied as tape. Recently Underwriters' Laboratory approved silicone-rubber fixture wire for 200-C use and building wire for 125-C special applications. Generator lead cables rated at 15 kv have been in service for several years.

Current-carrying capacity is greater for silicone-rubber-insulated than for plastic- or rubber-insulated cables. Where voltage drop is not a factor, smaller-diameter silicone-rubber-insulated wire can be used. You get substantial savings in installation labor and cost is competitive with organic insulations when based on current-carrying capacity.

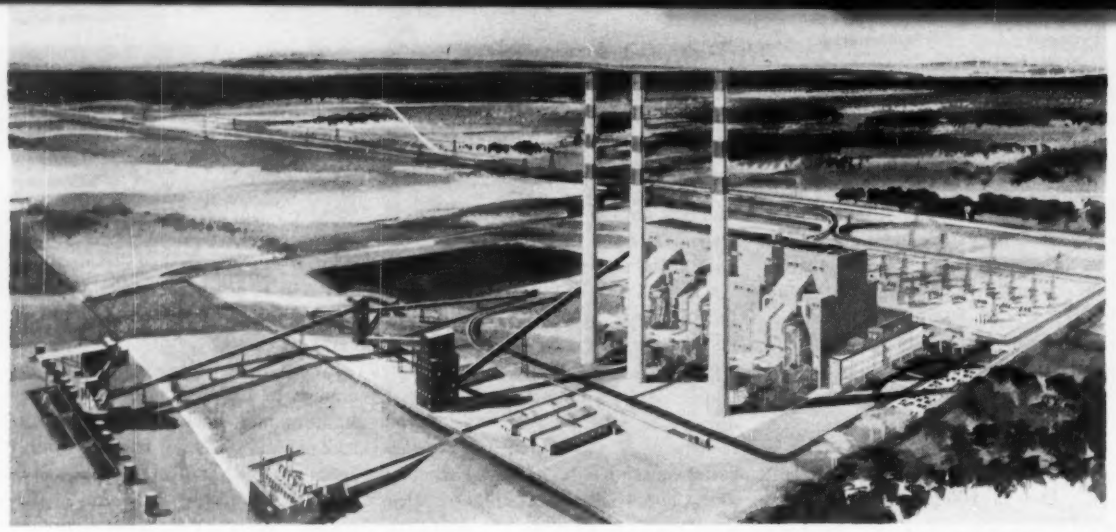
Another use applies silicone compounds to high-voltage porcelain insulators and bushings, to eliminate leakage and flashover in many highly contaminated areas. Applied as a thick coating, this grease-like compound traps and encapsulates contaminating particles in a coating of silicone fluid, preventing formation of a conductive path. Since silicone coating resists weathering and remains water repellant, leakage current over coated insulators is low.

Silicone-insulated coils are used in relays, control solenoids, contactors and circuit-breaker closing and tripping solenoids. Because silicone fluids show only small changes in viscosity over wide temperature ranges, they are good hydraulic fluids for dashpots, time-delay mechanisms and viscous-damping devices.

Research on new silicone materials and improvements in present products are continuing. Resins that cure faster and have better mechanical strength will be available in the near future. Silicone rubber with higher tensile strength and greater toughness is under development. In addition, less-costly methods of applying silicone materials are being worked out. An interesting possibility combines silicone insulation systems with internal hydrogen cooling to increase machine ratings.

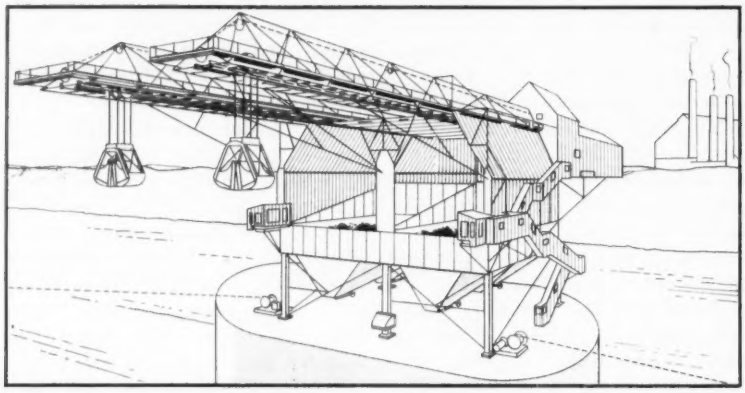
Nuclear-radiation-resistant insulating materials are necessary for use in electrical equipment associated with nuclear-power stations. Silicone-insulated control-rod drives, reactor coolant-pump motors and control wire are in service today in nuclear plants.

Laboratory tests have shown that heat plus radiation produces a much more severe environment than either heat or radiation applied separately. Accurate data on radiation resistance of materials is being obtained through evaluation programs conducted under actual operating conditions. These tests show that insulation systems based on silicone resins are among the most resistant to radiation.



STRIKING EXAMPLE of trend toward high handling rates is new Thomas H Allen station, City of Memphis Light, Gas and Water Div

By WILBUR G HUDSON
Consulting Engineer
Chicago, Ill.



SIAMESE-TWIN tower at Allen station has combined free-digging capacity of 26 tons per hr. Tower handles barges two at a time at an average rate of 1700 tons per hr

High handling rates, extensive use of automatic equipment, planning for overall growth of the plant are up-to-the-minute trends in . . .

Coal handling at

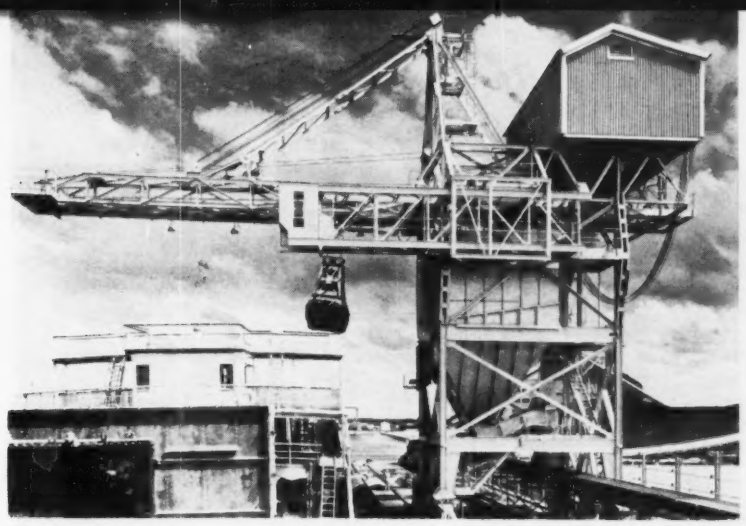
To the veteran power-plant design engineer looking back on his days at the drafting board, changes in engineering of coal-handling and storage layouts are impressive. In the old days routine layout was a "steeple tower" of 150 to 250 tons per hr capacity discharging through a 36x36-in. 2-roll crusher to a 30-in. belt conveyor. Reserve ground storage was piled astride a tunnel conveyor and reclaimed by gravity flow. This wasn't too good because it let gas filter downward into the tunnel, occasionally with serious results when coals ignited spontaneously. Who could foresee that ponderous bulldozers exhibited at the Road Builders Show in Chicago some 25 years ago were destined to play a major role in stocking out and reclaiming coal?

Today's design thinking in coal-handling layout is producing marvels of efficiency and capacity. In keeping with all good design philosophy, economics is the governing factor, but it can't be denied that some of today's layouts are good-looking jobs.

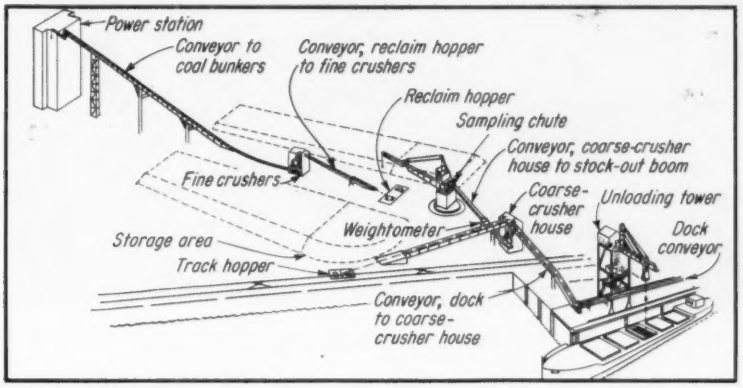
Waterside power-plant coal-handling layouts designed or constructed during the last four years are front runners in both efficiency and good looks. In general their layouts show design featuring (1) unloading towers with capacities up to 2600 tons per hr (unless served by a Lake-type vessel) (2) belt conveyors ranging from 42 to 60 in. and (3) bulldozers and carryalls rated at 15 tons or more per load. Let's take a look at several interesting waterside-plant coal-handling systems.

Thomas H Allen station of Memphis Light, Gas & Water Division, above, is a striking example of the trend toward higher handling rates. A municipal station costing an estimated $122 million, it has initial capacity of 812,000 net kw.

Coal barges can be unloaded in pairs by a Dravo Siamese-twin



TRAVELING TOWER and hopper team speeds flow at Tampa Electric's Gannon station



DOCK-LENGTH CONVEYOR takes coal from tower's hopper, *above*, feeds to station's high-capacity system. Handling rate of about 500 tons per hr will double in future

waterside plants

tower, lower drawing. Each hoist operates a 13.3-ton-capacity dc-powered bucket, providing a combined free-digging capacity of 2600 tons per hr, a record to date, with an average rate of 1700 tons per hr. Buckets discharge to twin hoppers from which belt feeders control flow to twin 48-in. inclined conveyors (combined capacity: 2000 tons per hr) extending to a transfer tower.

If coal destination is ground storage, one set of conveyors bypasses transfer house, sends coal to a 60-in. stacker conveyor which forms initial pile. If bunkers are coal's destination flow is diverted in transfer house to another conveyor. Here, at 1100 tons per hr, coal discharges to a surge bin in the crusher house where vibrating feeders split the stream equally between two hammer mills. The mills, each driven at 720 rpm by a 1250-hp motor, reduce the –2-in. coal to 4 mesh and it passes to the bunkers via more conveyors. Coal from reserve storage is reclaimed by carryalls to 48-in. conveyors which shunt it to other parts of the system.

Present layout provides for future expansion of the power plant and for future deliveries of coal by rail.

Gannon station of the Tampa Electric Co recently put a topnotch coal-handling system into operation. Gannon is a 3-stage project, with 125,000-kw Unit No. 1 gulping approximately 1000 tons of coal per day. Unit No. 2, just being completed, will provide another 125,000 kw and Unit No. 3, scheduled for 1960, will up station capacity by 170,000 kw. Present coal-handling capacity of 500 tons per hr can be increased to 1000 tons per hr.

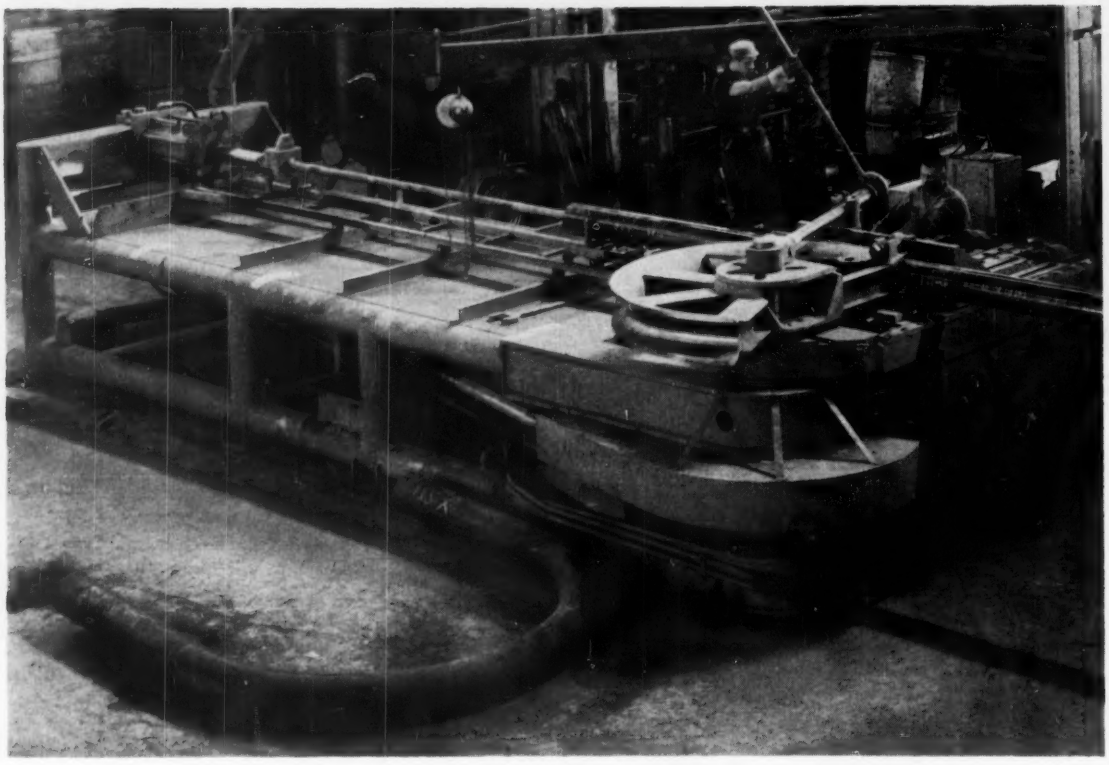
Waterborne coal is unloaded by a traveling Mead-Morrison tower having a 6-ton bucket and rated at 700 tons per hr in free digging, photo, above. Discharging to a feeder-equipped hopper, system provides continuous flow to a 42-in. dock-length conveyor for about 15 minutes when tower is shifted to different positions along the vessel. Coal continues to crusher house and on to a pivoted stock-out boom.

Total inactive reserve storage, spread and reclaimed by bulldozers, is 400,000 tons. The 36-in. conveyors take coal from reclaim hopper through a secondary crusher where it's reduced to four mesh for the cyclone burners. Bottom drawing, this page, shows system layout. Note Weightometer located between primary crusher and staker.

Detroit Edison's River Rouge station is still another example of modern coal-handling technique. A self-unloader at the dock discharges at 2500 tons per hr to a 60-in. belt conveyor extending to the breaker house. Here the coal may be sent either to the power house by tandem 48-in. conveyors or to ground storage. For ground storage, a 60-in. stacker conveyor swinging automatically through a 165-deg horizontal arc moves gradually through its travel as the pile builds up to a predetermined height. When 20,000 tons have accumulated or when stacker reaches end of its arc, feed to stacker automatically stops.

Reclaimed coal feeds to a 60-in. x 500-ft conveyor extending to the breaker-house surge bin and into the breakers, then moves to transfer house No. 1 on two 48-in. conveyors equipped with Weightometers. Movement continues on tandem 48-in. conveyors to the bunkers.

Handling rate from self-unloader to stockpile is 2500 tons per hr. From stockpile to bunkers it's 1000 tons per hr—this will double in future.



MODERN power-driven rotary cold-bending machine, special forming pressure, clamping dies and mandrels give uniform-radius bends

Why not cold-bent piping?

Cold bends can reduce design, fabrication and erection costs of your new or expanded piping system

By HELMUT THIELSCH, Metallurgical Engineer, Grinnell Co, Inc

Piping is the arterial system of any industrial plant. It conveys liquids, gases and slurries. And in many plants considerably more steel is used for piping than for plate in pressure vessels, tanks and other container shapes. But, since most studies of steel properties are made on plate products, far more is known about plate than piping. The major *Codes* cover plate materials extensively, but treat pipe products only slightly and incompletely. As a result, many design engineers approach piping design and specification from a far more conservative viewpoint than design of pressure and other containment vessels.

Undue concern generally is applied when cold-forming piping. Although cold bending is extensively done with pipe and tubing up to 2½-in. OD, little use is made of cold-bent piping in larger diameters. In Europe, however, cold-bent piping in sizes up to 12-in. has been widely accepted and is often preferred to hot-bent piping because of savings involved.

Design engineers commonly object to cold-bent piping because of possible effects of the cold-working operations on the piping material's service behavior. But the same engineers are apt to accept fittings, extrusions or seam-welded pipe made by cold-forming processes. And they might not be averse to use of cold-pressed dished heads in which wall thinning at the head's center can amount to as much as 20% of the original wall thickness, a sizable amount.

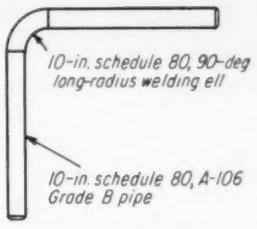
Cold-expanded pipe grades are covered by American Petroleum Institute specifications. This piping is used extensively in gas-transmission

VARIOUS BENDS and shapes possible with cold forming are almost limitless. These configurations are common in plant piping systems

Approximate cost comparison—elbow vs pipe bend

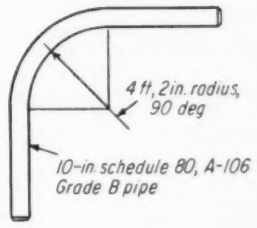
Fabricated section with elbow

10-in. schedule 80, A-106 Grade B pipe 18-ft 8¼-in. long	$223.13
10-in. schedule 80, 90-deg long-radius elbow, 1	185.25
10-in. schedule 80 commercial backing ring, 2	2.06
10-in. schedule 80 butt welds	109.70
10-in. schedule 80 37½-deg bevels	6.98
Total	$527.12



Fabricated section with bend

10-in. schedule 80, A-106 Grade B pipe 19-ft 4 13/16-in. long	$231.80
10-in. schedule 80 pipe bends, 90 deg, 1	94.50
Total	$326.30



Tabulation represents a hypothetical case involving 10-in. schedule 80 pipe and elbows. Difference in cost could be higher or lower depending on amount of welding, pipe lengths purchased, number of cold bends required, etc. When using alloy-steel pipe, or where carbon-steel pipe wall thickness exceeds ¾-in., cost of construction with elbows increases because additional welds mean more preheat and stress-relief operations

lines. Cold rotorolled 4135 alloy-steel and Type 410 stainless-steel tubing having minimum specified yield strengths of 90,000 to 100,000 psi have been used successfully in the chemical industry's polyethylene plants. In the annealed condition the 4135 and Type 410 steel grades exhibit yield strengths of approximately 60,000 and 40,000 psi respectively.

Advantages of bends. By using bends (made hot or cold) cost of materials, piping-system fabrication and erection can be reduced significantly compared with systems in which elbows are used exclusively, see box, above. Generally, fewer butt welds are necessary when using cold bends with tangents instead of fittings and welded-on spool pieces.

Where fitting-to-valve or fitting-to-flange joints may require special spool pieces and two butt welds, at least one spool piece and butt weld may be eliminated by using bends with tangents of sufficient length.

Another advantage of bends over elbows is less resistance to flow due to larger radius (long sweep) of the bends. Standard radius of a pipe bend is normally held to five pipe diameters, keeping always-expensive friction losses, erosion and turbulence to a minimum.

Outer wall thinning generally is less in cold bends. In fact, since cold bends usually are not stress relieved the cold working increases the outer wall's hardness and strength. Thus the completed bend may be stronger than the original pipe.

Change in wall thickness is uniform in cold bends, whereas it may vary in hot bends because of local variations in pipe temperature during

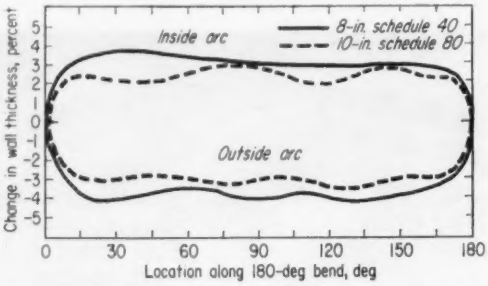
bending and shrinkage while the pipe is cooling. But it is not implied that cold bends are preferable for all applications. Some steels are susceptible to strain aging and temper brittleness. If cold worked they may suffer serious loss in ductility and toughness when exposed to high temperatures. Though hot bends appear to offer superior quality and a higher level of safety in h-t service, it must be recognized that fabrication involves tightly packing the pipe with sand and hot bending it to exacting tolerances.

Uniform radius during cold bending requires special power-driven bending machines. Photo, p 70, shows one of the heaviest and most modern machines. During bending, pipe section being bent at any one time is at the contact area between straight pipe and curved form. Critical bending area is always fully supported and pipe is evenly worked along length of the bend because mandrel is inserted in the pipe at the contact area. Plot, top, gives wall-thickness measurements for several 180-deg bends.

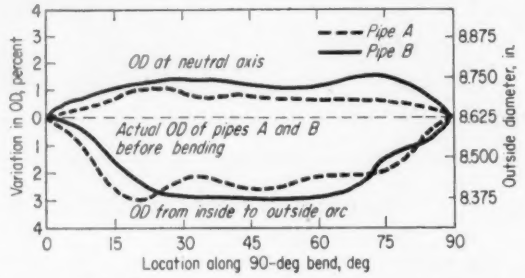
Flattening from nominal OD will be about 3% for pipe of proper OD matching the pressure die. It will form a concave contour. Plot, center, shows typical values for 8-in. schedule 160 pipe. Where actual OD varies significantly from nominal OD (for which bending shoes are designed), hot bending of sand-filled pipe may be preferred if allowable flattening is critical. But since cold bends are furnished with uniformly round tangents slight flattening can be inconsequential.

Shapes and bends possible are almost limitless. Photo, p 71, shows types of bends used in an average installation. Unusually sharp radii and heavier wall thicknesses are produced with a shoe guide, ball mandrel, or both, right.

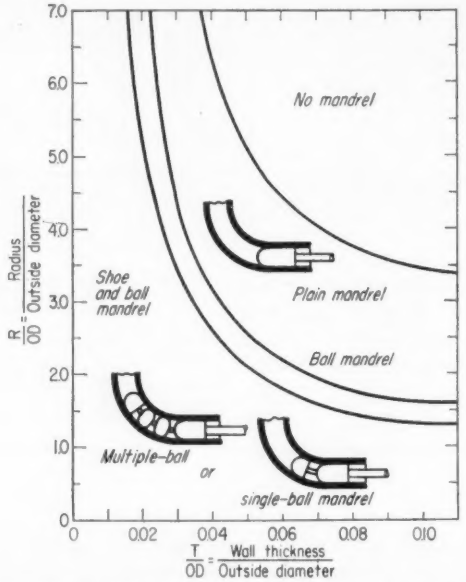
Cold-bent piping is now used in almost every type of system without adverse effects on service life of materials involved. If piping is properly designed and fabricated, cold-bend performance will be equal to that of bends made by hot methods.



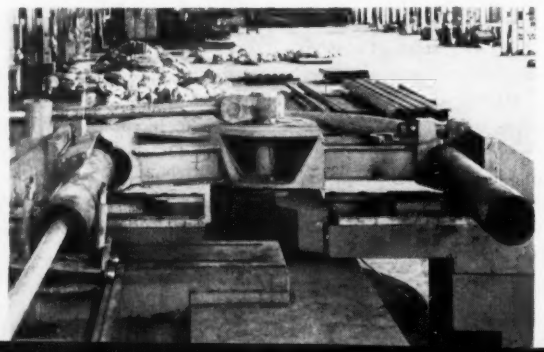
WALL-THICKNESS variation, inside and outside arcs, is typical of 8-in. sch 40 and 10-in. sch 80 carbon-steel pipe with 5-dia radius


Variation in OD, percent
Pipe A
Pipe B
OD at neutral axis
Actual OD of pipes A and B before bending
OD from inside to outside arc
Outside diameter, in.
Location along 90-deg bend, deg

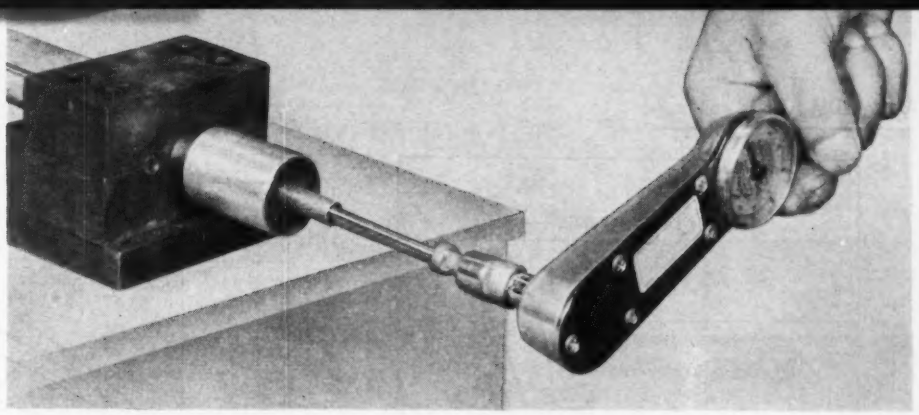
FLATTENING plot shows typical out-of-round in two 8-in. sch 160 carbon-steel pipe bends which were made to standard 5-dia radius



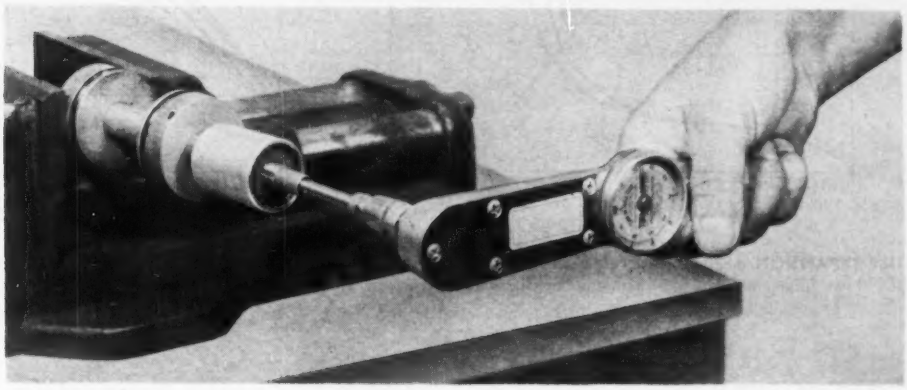
SPECIAL SHAPES having sharp radii or heavier wall thickness cost more. They're made by using shoe or ball mandrel or both



COMPLETED 180-deg U-bend in sch 80 pipe ——▶



TUBE-ROLLING TECHNIQUES were tested in split tube sheet, allowing inspection of tube's outer surface



JOINT-FAILURE TEST required free rolling in tube-sheet pistons to prevent buildup of residual joint stress

Now, better rolled joints for aluminum

Use of aluminum tubing for heat exchangers requires special techniques for satisfactory rolled joints. Our research project developed several simplified design criteria and construction methods you can use

By H E LINTHICUM, Research Engineer
Elliott Company, Division of Carrier Corp, Springfield, Ohio

Effect of rolling on aluminum tubing has long been a problem because of failure to secure tight joint or injury in the form of flaking.

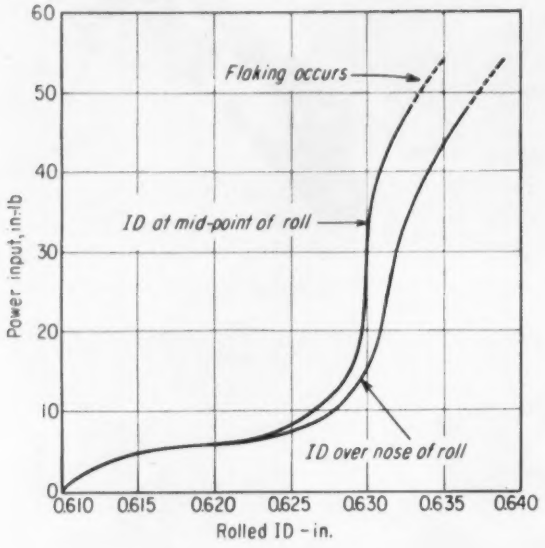
To find out why these defects are more common in aluminum tubes than in other types of metals we ran a series of laboratory tests based upon actual conditions encountered in field fabrication. Our results proved that proper matching of tube-rolling technique and tube alloys overcomes problems of joint failure. If you keep these principles in mind when specifying heat exchangers, you can count on trouble-free operation later on.

Some aluminum alloys are hardened by cold-working or strain-hardening, while others are thermally treated to produce certain physical properties. Both of these alloy types find use in heat exchangers.

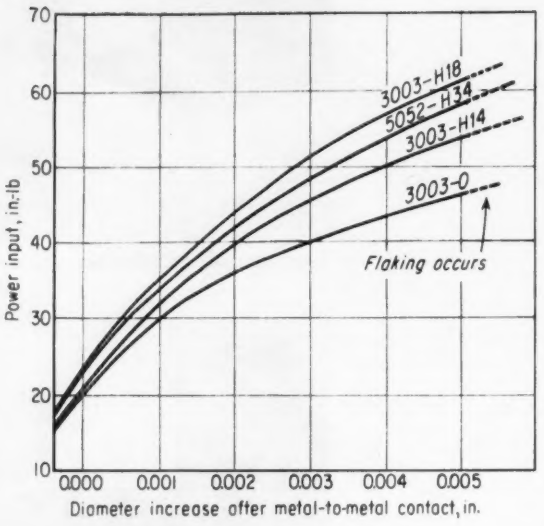
Test results clearly indicate that each of the two alloy types reacts differently when cold-worked by a tube-rolling tool. What happens to metal of tube after contact is made with tube sheet holds the secret of a rolled joint that has pullout strength and sealing ability compatible with metals of the tube and tube sheet.

Test method entailed rolling commercial tubes of 3003, 5052, 6061 and 6063 alloys, having various tempers, into given-diameter tube-sheet hole. Roller was conventional taper mandrel-roll type tool driven by a sensitive torque-measuring device. We rolled each tube to increasing tightness until visual flaking occurred in the tube.

Inside-diameter measurements were taken at various points along rolled section and plotted vs input power to rolling tool, see curve, next page. Due



TUBE-EXPANSION measurements vary along length of roller contact. Least diameter coincides with mid-length of rolled section



HARDENED ALLOYS introduced problem of narrow range between yield point and tensile strength. Tempering merely boosted torque

to low yield strength of aluminum there is definite hourglass shape inside rolled sections. There is a very small enlargement with increasing power at the mid-length of the roll, while enlargement at nose end of the roll is proportional to power input to the tool. Therefore, all inside measurements should be made at point of largest inside rolled diameter.

Degree of temper of same alloy did not change amount of tightness alloy could withstand before flaking. However, increasing temper required increasing power input to obtain same amount of tightness, curve, above. Alloys used for these tests were of nonheat-treatable type. By comparing results of tests with physical properties of the alloys we found the reason for problems with nonheat-treatable alloys.

Range between yield and tensile strengths of nonheat-treatable alloys is very narrow. Also, these alloys are strain-hardened by cold-working process which imparts stressed condition to the metal. Rolling action of tube expander causes an increase in yield strength by cold-working the metal. When increasing yield strength equals or exceeds tensile strength of the metal, a burst or rupture occurs in the form of flaking, and permanent injury to metal of the tube results.

Effect of heat-treating shows in final curves. We found that heat-treatable alloy can be rolled a greater amount before flaking occurs. There is a wider range between yield and tensile strengths and alloy is free of locked-in stresses. So heat-treatable alloy is not as susceptible to effects of cold-working.

Other heat-treatable alloys will follow same rolling pattern unless thermal treatment is followed by work-hardening to secure certain physical properties; when this is done metal will act as though it were of nonheat-treatable type. This effect showed up in rolling results of 6063-T831 alloy which is solution heat-treated, strain-hardened and artificially aged.

Rolling tests indicate that rule-of-thumb method for determining tightness of joint must be revised to allow for closely controlled thinning of tube wall. Also, lesser clearance between tube OD and tube-sheet hole diameter will reduce cold-working applied to nonheat-treatable types of alloys. These precautions are particularly necessary for thin-wall tubes and small-diameter tubes.

Types of lubricant used with rolling tool had no apparent effect on results of rolling. Tubes will always flake when rolled beyond their capacity for cold-working. Water-soluble lubricant is more easily removed and quantity used does not affect quality of rolled joint.

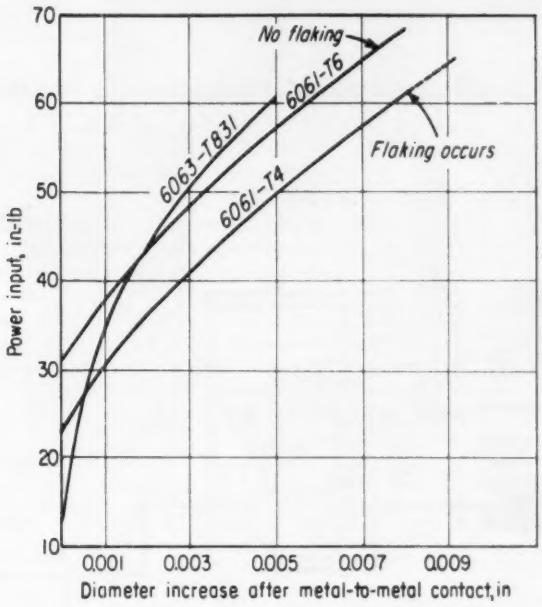
Speed of rolling tool had no apparent effect on quality of the rolled joint, providing amount of rolling was within boundaries established by rolling tests. Speeds up to 1000 rpm were successfully used.

Joint-failure tests determined value of rolled joint having tightness within boundaries established by rolling tests.

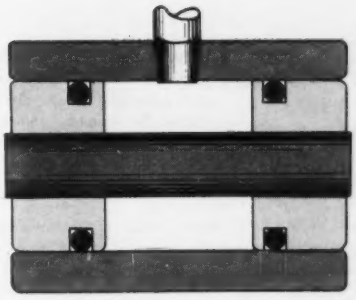
Each of alloys and tempers used in rolling tests was subjected to tensile and pressure test duplicating normal conditions of use. In this series tube sheets were of hardened steel, with holes ground to a smooth surface; no grooves were used. Therefore, joint strength was a measure of hoop stress in rolled joint. Test apparatus, opposite, applied simultaneous tensile-static pressure test to obtain measure of sealing ability of rolled joint.

Numerous tests were made by rolling tube into hardened tube sheet to various amounts of tightness after metal-to-metal contact, with same rolling tool used for rolling tests. Pressure at which tube slipped in tube sheet was taken as value of the rolled joint.

Optimum tightness for rolled joint corresponded to tube ID in-



LOWER YIELD POINT of nonhardened heat-treatable alloys allows more tube expansion without exceeding tensile strength



TEST APPARATUS applied simultaneous pull out and leakage tests to the joints

crease of .0035- to .004-in. after actual contact of tube with tube sheet. At this optimum, we recorded tensile loading equal to or slightly less than tensile strength of unrolled tube.

Tubes rolled to flaking point had tensile loading nearly one-half that of an optimum rolled tube. Tubes rolled to .002-in. dia increase showed a fairly high tensile loading before joint slippage.

Tube rolled to optimum tightness could not be rerolled after slippage and regain original pressure and tensile loading values, while under-rolled tubes could be rerolled to .004-in. dia increase and regain values nearly equal to optimum rolling.

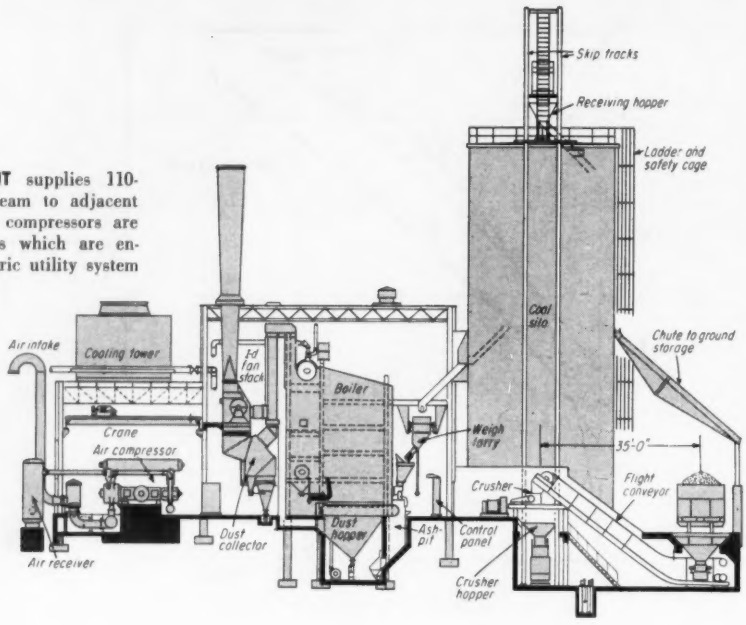
Tubes rolled to optimum tightness did not show further drop in static pressure after initial slippage in the tube sheet.

Conclusions. After rolling-technique and joint-failure tests, we concluded that adequate rolled joints can be produced using hardened or heat-treatable alloys, but the technique must match the alloy. Hardened alloys require close fit in the tube sheet and minimum expansion. New heat-treatable alloys may make the entire operation simpler in the future.

Summary of test results

Test number	1	2	3	4	5	6	7	8
Alloy number	3003-0	3003-H14	3003-H14	3003-H18	3003-H18	3003-H18	6061-T4	6061-T6
Tube OD, in.	.747	.750	.7505	.7505	.7505	.7505	.750	.748
Tube ID, in.	.610	.610	.610	.610	.610	.610	.611	.610
Torque input, in.-lb, tube sheet 1	43	33	52	50	see note	see note	52	70
Rolled ID, in., tube sheet 1	.630	.6255	.6265	.6255	(1)	(2)	.6275	.6265
Torque input, in.-lb, tube sheet 2	46	33	59	50	58	65	51	70
Rolled ID, in., tube sheet 2	.632	.6255	.628	.625	.629	.632	.627	.626
Failure in tube sheet	No. 2	No. 2	No. 2	No. 2	No. 2	No. 2	No. 2	No. 2
Pressure at failure, psi	335	440	460	440	480	380	710	910
Net tensile force, lb	2077	2728	2852	2728	2976	2359	4402	5642

(1) End that failed was rerolled (2) End that failed second time was rerolled



POWER-SERVICES PLANT supplies 110-psig air and 125-psig steam to adjacent auto-assembly plant. Air compressors are driven by electric motors which are energized by the local electric utility system

By E J HEALY, Vice-president, Construction
W J FADDEN JR, Chief, Mechanical Department
D S EILER, Project Engineer, The Kuljian Corporation

Lorain, Ohio, assembly plant of Ford Motor Company has its power-services plant installed in record time of nine months. Prime services supplied by the new plant include . . .

Compressed air and steam as needed

The Lorain assembly plant needed 264,000 lb steam per hr and 10,000 cfm of 110-psig air in addition to electric power from the local utility system. Plant, above, was designed and built to meet these needs with low operating and maintenance costs. Layout provides for adding a fourth boiler unit and a fifth air compressor.

Fuel and ash. Railroad cars deliver bituminous coal by dumping it into a track hopper. A reciprocating feeder passes coal from the hopper to an inclined flight conveyor—larger angle of inclination allowed by a flight conveyor permitted placing hopper close to building.

A magnetic separator at the end of the conveyor removes tramp iron. From here the coal goes to a crusher, a hopper and a skip hoist. Hoist lifts the coal to the silo top where an electrically operated diversion gate directs the coal to either the silo or yard storage for reclaiming by bulldozer.

Coal flows from silo to a weigh larry that serves the three boilers. Spreader stokers fire the coal on grates traveling toward front of the boilers. Refractory-lined concrete hoppers built integral with the foundation store the ash. A steam-evacuated vacuum system carries ash from the ash hoppers, sifting hoppers and dust collectors to an outdoor overhead storage silo. After conditioning it discharges to rail car or truck.

Flyash from last-pass hoppers and primary dust collectors reinjects into the furnace to recover unburned carbon. Secondary air fans reinject the flyash and supply overfire air.

Boilers. Each of the three boilers has a tubular air heater and a mechanical dust collector. Combination i-d stacks make a compact arrangement. Arrangement of dust collectors, f-d fan and i-d fan needs very little ductwork.

All auxiliaries for one of the boilers have dual drives, motor and turbine, each equipped with a free-wheeling coupling to disconnect the turbine as needed. Placing both f-d and i-d fans on the upper fan floor keeps building volume to a minimum. All fan controls are on the fan floor.

Electrical combustion-control system centralizes the controls of all three boilers. It automatically controls plant output down to a minimum of 15,000 lb per hr. Panel stands next to No. 1 boiler and holds all recording flowmeters and miscellaneous instruments.

A continuous-blowdown system uses a heat exchanger to recover some heat by transfer to raw makeup entering the softener.

Air compressors. Air from the four compressors passes through aftercoolers before entering the air receivers. A glycol-absorber dryer removes moisture from the air (to not over 53-F dewpoint) before it goes to the assembly plant. Dryer has enough capacity to accommodate a fifth air compressor in the future.

Principal power-plant equipment, Ford Motor Company, Lorain, Ohio

Steam-generating equipment:

Boilers, 3 — Erie City Iron Works
80,000/88,000 (2 hr) lb per hr each, 125 psig, saturated, 2 drum, 11,200 sq ft heating surface, 4510-cu-ft furnace, 23,100 Btu per hr per cu ft heat release, 2100-sq-ft waterwall surface, coal fired, reinjection system

Air preheaters, 3 — Erie City Iron Works
Counterflow, single pass, 5690-sq-ft effective heating surface

Stoker, reinjection systems, 3 — Hoffman Combustion Engineering Co
Spreader type, continuous ash discharge, one unit dual drive

Ducts and breeching — A J Schmidt and Co

Soot blowers — Vulcan Soot Blower Corp
Four per boiler (one in air heater)

Forced-draft fans, 3 — Buffalo Forge Co
27,400 cfm, 6.65-in. water, 80 F, variable inlet vanes, one dual drive

F-d fan motor drives, 3 — Westinghouse Electric Corp
40 hp, 1200 rpm, 220/440 v, 60 c, 3 phase

F-d-fan turbine drive, 1 — Elliott Company
32 bhp, 1160 rpm, 120-psig, 350-F inlet, 5-psig exhaust

I-d fans and stacks, 3 — Prat-Daniel Corporation
71 bhp, 1180 rpm, 7.3-in. water, 378 F, 126,500 lb gas per hr, one dual drive, stack 5.5-ft dia, 54-ft high

Dust collectors, 3 — Prat-Daniel Corporation

I-d-fan motor drives, 3 — Westinghouse Electric Corp
75 hp, 1200 rpm, 220/440 v, 60 c, 3 phase

I-d-fan turbine drive, 1 — Elliott Company
71 bhp, 1160 rpm, 120-psig 350-F inlet, 5-psig exhaust

Combustion control and instruments — Hays Corporation

Feedwater equipment:

Boiler-feed pumps, 3 — Allis-Chalmers Mfg Co
Two 300 gpm, one 180 gpm, one stage, double suction, centrifugal units

Boiler-feed-pump motor drive, 1 — Westinghouse Electric Corp
75 hp, 3600 rpm, 220/440 v, 60 c, 3 phase

Boiler-feed-pump turbine drives, 2 — Elliott Company
75 bhp, 3500 rpm; 34 bhp, 3500 rpm; 120-psig 350-F inlet, 5-psig exhaust

Hot-lime-soda water softener — The Permutit Company
Vertical, closed outdoor type, 270,000 lb per hr, deaerating, 10-min storage capacity, 5-psig shell press.

Hot-lime-soda filters, 3 — The Permutit Company
66-in. dia, 4-ft high, vertical, anthracite, 10,000 gph at 50 psig

Continuous blowoff equipment — The Permutit Company
24-in. dia, 5-ft high, straight flash tank, 67-sq-ft heat exchanger, total makeup of 90,000 lb per hr

Feedwater regulators, 3 — Copes-Vulcan Division

Condensate-return system, 60 gpm — Aurora Pump Co

Chemical-feed pumps, 4 — Milton Roy Company
Simplex plunger, controlled volume, 0-100% capacity variation, three for acid phosphate, one for sodium sulfite

Chemical-feed-pump drives, 4 — General Electric Company
¼ hp, 440 v, 60 c, 3 phase, totally enclosed gearmotors

Piping fabricator — Blaw-Knox Co

Valves — Edward Valve Co
Wm Powell Co
Lonergan Valve Co
Fisher Governor Co
Mason-Neilan Div

Insulation — The Asbestos Service Co

Miscellaneous piping equipment — Leeds & Northrup Co
Automatic Switch Co
Mercoid Corporation
Bailey Meter Co

Fuel equipment:

Coal-handling system, 50 tph — Beaumont Birch Co
Track hopper, flight conveyor with magnetic separator, crusher, skip hoist, weigh larry, car puller, 30-tph yard storage

Coal-storage silo — Custodis Construction Co, Inc
30-ft ID, 98-ft high, concrete, 600-ton active capacity

Ash-handling system — National Conveyors Co, Inc
Pneumatic conveyor, steam operated, 46-ton live storage silo

Air compressors:

Air compressors, 4 — Cooper Bessemer Corp
Motor driven, reciprocating, horizontal, opposed, 2050 cfm, 110 psig, two stage, automatic unloading

Intercoolers, 4 — Patterson-Kelly Co, Inc
2024 scfm, 275 to 100 F, 440 sq ft, eight pass, tube side

Aftercoolers, 4 — R P Adams Co
2500-cfm free air, 110 psig, two stage, 200-sq-ft surface

Air filters, 4 — Dollinger Company
180-sq-ft surface, 3200 cfm free air

Compressor drives, 4 — The Ideal Electric & Mfg Co
400 hp, 400 rpm, 440 v, 60 c, 3 phase, synchronous motor

Motor-generator sets, 4 — The Ideal Electric & Mfg Co
Two unit, 1750-rpm; primary 15 hp, 440 v, 60 c, 3-phase induction motor; secondary, 7.5 kw, 125/250 v, dripproof, dc exciter

Air dryer — T Melsheimer Co
10,000 cfm, glycol absorber, 110 psig, air not over 53-F dewpoint

Cooling tower, 1 — The Marley Company
Horizontal, double flow, redwood construction, 600 gpm, 107 to 85 F with 75-F wet bulb

Cooling-water pumps, 2 — Worthington Corp
644 gpm, 67-ft head, driven by 15-hp 1800-rpm 440-v 60-c 3-phase induction motor

Miscellaneous equipment:

Electrical work — Lake Erie Electric Co, Inc

Motor-control centers — Artcraft Electric Supply Co
Machinery Electrification, Inc

Booster pumps, 3 — Worthington Corp

Air receivers, 4—202 cu ft — Buffalo Tank Corp

Blowoff tank — Buffalo Tank Corp

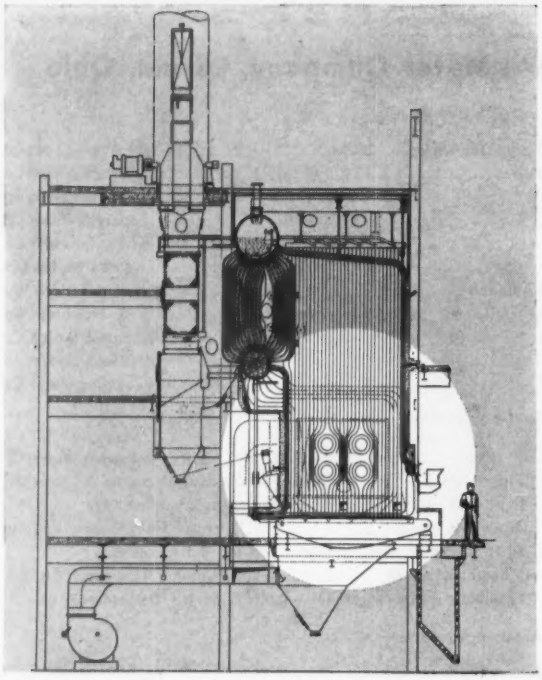
Crane, 5 ton, 32-ft span — Manning, Maxwell & Moore

Engineers and constructors — The Kuljian Corporation

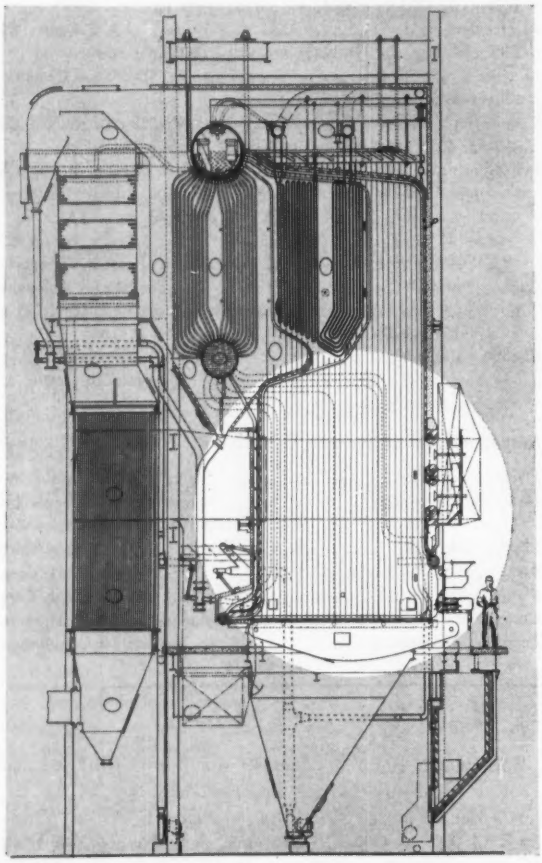
Each compressor is driven by a 400-hp 400-rpm synchronous motor. Each unit has its own m-g set to provide 7.5-kw 125/250-v dc excitation.

Cooling system. A complete closed cooling-water system serves the bearings and jackets in the plant. Induced-draft cooling tower on compressor-room roof rejects the heat to atmosphere. Two pumps in the basement circulate cooling water through system and back to cooling tower.

Electric service. Utility service enters the electrical bay at 11 kv. Switchgear distributes 440-v power to boilers and compressors and both 13.8-kv and 440-v power to the assembly plant by underground cables.



SIDE-WALL LOCATION of burners may be necessary because of ignition arch. Intertube gas burners are available for waterwalls



FRONT-WALL LOCATION of burners is compromise between protection for stoker and preventing excessive final steam temperature

Converting to gas firing?

These tips may steer you around some common problems

By J M TOTTEN, Chief Power Engineer
Stone & Webster Engineering Corp

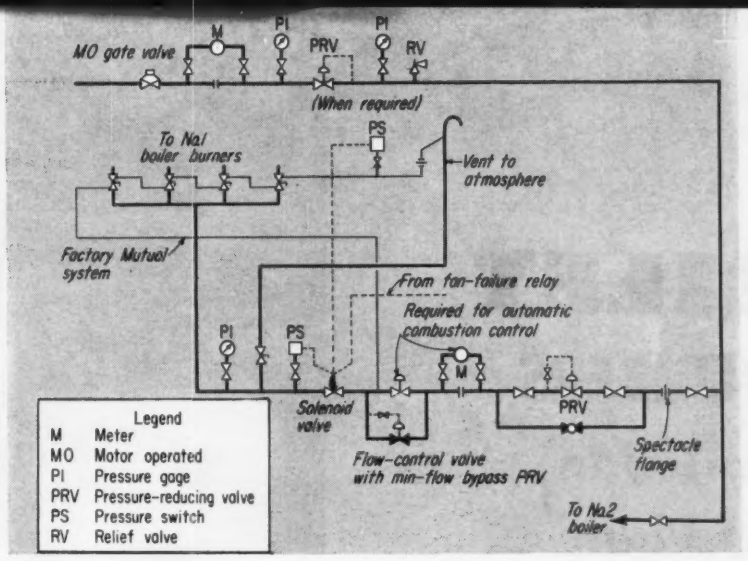
As the network of natural-gas arteries continues to expand across the country this fuel becomes available for steam-generating units which formerly had to rely entirely on solid or liquid fuels. Many plants, wanting to take advantage of benefits peculiar to gas firing, convert too hastily without being entirely familiar with the newcomer. Consequently, they run into problems. Number and character of problems depend largely on the existing boiler's characteristics—it's likely that a stoker-fired unit will present more problems than one fired with pulverized coal or oil. Let's look at some typical situations and possible solutions.

Burner placement in a stoker-fired boiler's furnace usually means a compromise between a desired high or low location in the front wall. High location could result in excessive steam temperature; low point could overheat an idle stoker. Stoker, of course, can be protected by several courses of firebrick. If this isn't practicable because stoker may be needed in a hurry, a thick covering of ashes or crushed firebrick will provide required insulation, but can be quickly removed.

Ignition arch may make front-wall burner location difficult. Sometimes this can be overcome by putting burners in the furnace side walls, but many older plants have narrow aisles between boilers which make it hard to install air ducts and gas-burner piping properly. Regardless of where burners are located, flame impingement on furnace floor or side walls must be prevented. Drawings, left, show typical good burner installation in both locations.

Gas-burner types. Properly designed ring type burner in a circular port has proved satisfactory in refractory furnace walls. When not in service it withstands radiant heat from other fuels being burned. So does the multispud burner arranged in a circular port, but this cannot be said of the circular port burner with a single spud. This type may be severely overheated.

Burners in continuous service are less apt to be damaged by overheating than those periodically exposed to heat from an active stoker. Common practice is to admit cooling air to idle burners, but this lowers combustion



FURNACE EXPLOSION is probably greatest single hazard in gas firing. Protective systems such as that shown will eliminate hazard to a large degree, but much depends on operator training

efficiency. Hinged burners have been developed which are swung out of position when not in use, their ports closed with refractory plugs.

Intertube burners which produce a satisfactory gas flame are available for water-cooled walls. But the combination gas-oil intertube burner hasn't proved to date that it is capable of doing an efficient job.

Draft system for the average existing stoker-fired boiler should be adequate for gas firing. But air leakage into the furnace must be prevented to a finer degree with gas firing. Besides preventing good combustion, air infiltration may keep combustion from being completed in the furnace. Resultant long flame may extend into the superheater, cause excessive steam temperature. In short, all combustion-air supply should come through the burners, and it's important that air supply be distributed equally between all burners. Experience has shown that air distribution can be a problem with as few as two burners. It's important, too, that gas burners have the same pressure-drop characteristic as the fuel bed of the stoker.

Final steam temperature at superheater outlet will be higher at all loads with gas firing. Since the flame is less luminous than that from coal or oil less heat is transferred by radiation. Consequently, temperature of gas entering superheater is higher.

Steaming capacity may or may not increase with conversion to gas. It will if boiler's capacity had previously been limited by maximum rate at which fuel could be supplied. Capacity increase should be carefully checked because it may mean a need for increased safety-valve relieving capacity.

Standby fuel supply required will depend upon whether it's necessary to change quickly from gas to the standby fuel. If gas supply is on a firm schedule basis there may be adequate time in which to change from gas to stoker firing. But if gas supply may be interrupted on very short notice it'll probably be necessary to provide light or heavy fuel oil as standby fuel. In this case, combination gas and oil burners should be installed.

Simultaneous firing of gas and other fuels presents no serious obstacles. But because of wide variation in CO_2 in the flue gas from natural gas and other fuels, it's desirable to control combustion on the basis of CO_2.

Automatic combustion control. Most common form of control varies fuel supply in relation to the steam demand so as to maintain constant steam-header pressure. Air supply is varied in proportion to fuel requirements, air generally being controlled at the f-d fan and furnace draft by dampers at the i-d fan.

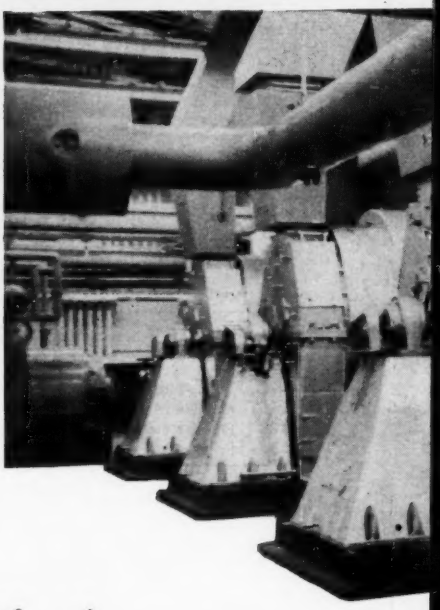
Ignition devices. It is entirely practicable to light off gas burners with an ordinary oil-swab manual lighter. However, on larger installations usual practice is to provide automatic ignition torches lit by electric spark which are permanently installed close to each burner. These special torches are a necessity when furnace is operated under positive pressure or when burners are operated by remote control.

Heat-liberation rates. Because there is no slag problem with gas as there is with coal or fuel oil, it's possible to operate with higher heat-liberation rates, both on the basis of Btu per hr per cu ft and Btu per hr per sq ft of projected area of the furnace envelope. Successful installations operate up to 35,000 Btu per hr per cu ft; over 125,000 Btu per hr per sq ft of projected area.

Gas is a dangerous fuel. It is an easy fuel to burn, but it's not easy to burn it efficiently and safely under all conditions. Stoker-bred operators must be trained in safe light-off and firing procedure. A number of gas-firing-system safety devices are available—most important one "locks out" fuel supply until furnace is completely purged. This is almost always a part of a safety-monitored gas-firing system. One example is the Factory Mutual system, above, which prevents a solenoid-operated gas-supply valve from opening until all burner cocks have been closed. This same valve is usually arranged to trip closed if fuel pressure or combustion air falters so as to prevent continuous stable ignition.

While some existing boilers may not lend themselves to conversion to gas as easily as others, it can be said with conviction that a converted unit *can* be operated as safely as one designed to burn gas.

With RILEY PULVERIZERS Installed In Your Plant

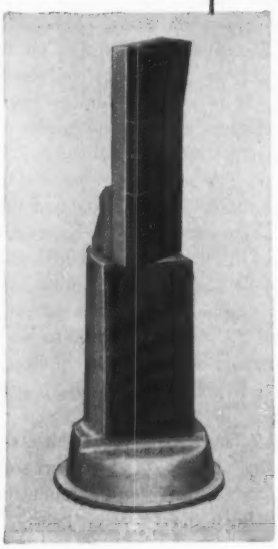


Silence is Golden

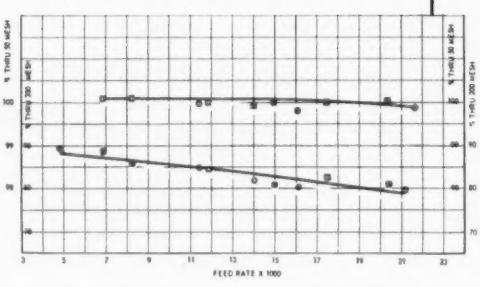
... Because Riley Pulverizers Operate Quietly

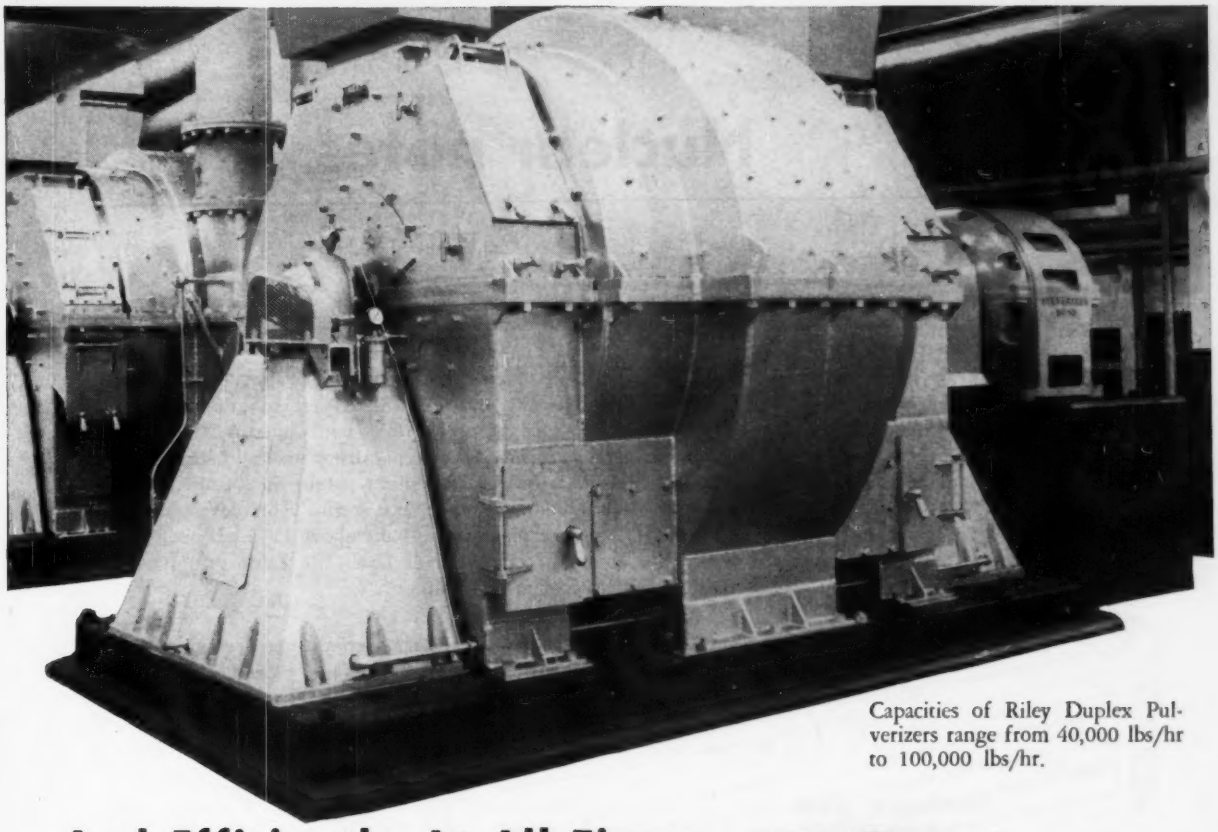
Other Advantages of Riley Pulverizers

- Wide fuel type range
- No loss of capacity with wet coal
- Ease of maintenance — minimum lubrication
- No adjustment needed to sustain fineness
- High primary air temperatures are used
- Sustained high fineness with tungsten carbide faced pulverizing elements
- Ease of automatic regulation
- Low power consumption
- Explosion proof
- Compact design, low foundation cost
- Rejections easy to remove
- Pressurized operation
- Wide capacity selection from 3,000 lbs/hr to 100,000 lbs/hr



At left is a typical pulverizing element faced with high grade erosion resistant tungsten carbide. At right are the results of fineness test conducted on a duplex type pulverizer. Test #1 ○ before elements were replaced; test #2 □ after new elements were installed. Results show no appreciable drop in fineness and capacity in either case.

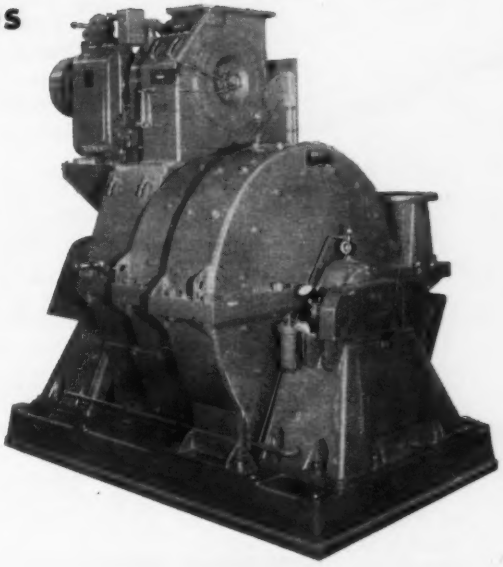




Capacities of Riley Duplex Pulverizers range from 40,000 lbs/hr to 100,000 lbs/hr.

And Efficiently At All Times

The Riley Pulverizer reduces coal to high fineness by attrition with no metal-to-metal contact . . . coal particles are reduced in size by impact against rotating and stationary pulverizing elements . . . *the action is soundless* . . . perfect balancing of all rotating elements assures smooth vibration-free operation. Visit one of the hundreds of plants using Riley Pulverizers . . . you'll be amazed at how comfortably you can hold a normal conversation in the pulverizer room.



Single Riley Pulverizer capacities range from 3,000 lbs/hr to 30,000 lbs/hr. Unit is equipped with Riley metering coal feeder with magnetic separator.

You'll find all the many operating and design characteristics of Riley Pulverizers fully explained in a new Pulverizer Catalog. For your own copy ask a Riley Representative in one of these cities . . . Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Jacksonville, Kansas City, Los Angeles, Milwaukee, New Orleans, New York, Philadelphia, Pittsburgh, Portland, St. Louis, St. Paul, Salt Lake City, San Francisco, Seattle, Syracuse, Worcester.

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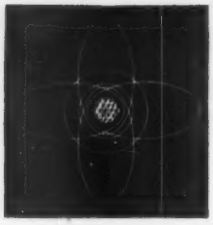
RILEY STOKER CORPORATION, WORCESTER, MASS.



Nuclear notes

By B G A SKROTZKI, Associate Editor

Three new plants are being offered by Westinghouse Electric Corporation to U.S. electric utilities. Integral boiling-superheating reactor with a core of graphite holds about 80 pressure tubes; UO_2 fuel elements in each tube boil water in 70% of the tubes and superheat steam in the remainder. An external drum separates steam from the water. The 865-psia 900-F steam produces station net output of 20 mwe. A helium loop cools the graphite in addition to the water and steam. This developmental plant might be forerunner of 200-mwe plant to be built about 1975. Economy of proposed prototype would not be up to conventional level. R&D for prototype is estimated at $11.3 million, capital cost at $17 million.

Combination plant uses a boiling-water reactor with external separating drums, canned-motor circulating pumps and fossil-fuel-fired superheater and reheater. The 2%-enriched UO_2 develops about 300 mwt and fossil fuel about 220 mwt for a station net output of 215 mwe. The 225-mw turbine takes steam at 1800 psig, 1000/1000 F to run at 9040 Btu per kwhr heat rate. Costs are estimated at 7.3 mills per kwhr.

Closed-cycle plant uses a pressurized-water reactor (2150 psia) with a 3-zone core. Inner circular zone uses 2.1%-enriched UO_2, inner annular zone 2.6% UO_2 and outer annular zone 2.9% UO_2. At refuelings inner core is removed and each outer zone moved into the next inner zone with fresh 2.9% UO_2 added in outermost zone. Reactor feeds five steam generators that supply 4.5-million lb per hr of 650-psi saturated steam to the 360-mwe steam turbine. Plant produces net of 330 mwe at an overall cost of 7.3 mills per kwhr.

Advanced Epithermal Thorium Reactor being studied by Atomics International for the Southwest Atomic Energy Associates has been completed in its first phase. This reactor would use a thorium-U-233 breeding cycle with neutrons in the 1000- to 100,000-ev range. A preliminary design indicates the sodium-cooled reactor could produce 360 mwe from 1800-psig 1000-F steam at a breeding ratio of 1.3. Atomics International offers copies of report *AI-3812* (174 pp) describing Phase I free of charge to those expert in the field of nuclear technology. Write AI at PO Box 309, Canoga Park, California.

Dresden Dual-Cycle Boiling-Water Reactor of the Commonwealth Edison Company has been licensed by the AEC as of Sept 28th, 1959, for installation of the initial fuel loading and operation at maximum power level of one mwt. The Advisory Committee on Reactor Safeguards has not completed its study of the plant.

Homogeneous reactors generally do not show promise of producing low-cost power when compared with other reactor types, an AEC study has concluded. Accordingly the AEC is now making "closeout" studies of the liquid-metal-fuel and molten-salt projects and is cutting back on the aqueous homogeneous project.

New books: *Nuclear Reactor Plant Data—Vol 1, Power Reactors, 1959,* by The American Society of Mechanical Engineers, 128 pp, 8x11, cloth, $3.75. McGraw-Hill Book Co, 330 West 42nd Street, New York 36, N. Y. Gives specific technical data for 32 plants in U.S.A. and foreign locations.

Nuclear Reactor Plant Data—Vol 2, Research and Test Reactors, 297 pp, 8x11, $7.50. Same source and publisher as above. Gives specific technical data for 53 reactors in U.S.A. and 42 reactors in foreign locations.

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BOB BELLAS, Associate Editor

Weighed and found wanting

Nomogram for figuring approximate weights of tubes and solid rods, while apparently correct in principle, is not correct as shown and is not compatible with the explanation (*Data sheet*, June, p 102).

In the example given, $D^2 - d^2 = 0.188$. However, 1.88 was used on the S scale to get the *correct* weight per ft of 0.502 lb. Actually, if 0.188 were used on the S scale the line would not intersect the W scale.

This suggests that one solution would be to multiply the W scale by 10 and extend it downward. This would be operationally inconvenient and lead to inaccuracies due to angle of intersection.

Our preferred solution would be to use a 1-in. round steel bar as a base. This would mean multiplying the W scale by 10, changing the range to 1.0 through 10.0 lb. Then following the procedure outlined in the explanation, weight would be found to be 2.53 lb per ft (using your nomograph, this would be 0.253 lb per ft, or less than the tube). Once the base is established, to stay within range of the scales used it would be necessary to adjust the $D^2 - d^2$ figure by multiplying or dividing by 10 and correct W scale reciprocally by dividing or multiplying by 10.

To illustrate, let's consider the original example $D^2 - d^2 = 0.188$. As we know, this will not intersect the W scale. Multiplying this by 10, we get 1.88 and the intersection on our revised W scale is at 5.02. Since we multiplied $D^2 - d^2$ by 10, we must divide value on W scale by 10 or read 0.502 lb as correct weight per ft.

Another example: Let's consider a 2-in. solid square bar of steel. A line connecting D^2 or 4 on the S scale with pivot on L scale does not intersect W scale. Divide 4 by 10 and use 0.4 on S scale which gives an intersection at 1.36 on W. By our rule this will have to be multiplied by 10 or result in 13.6 lb per ft. The weight per given length would also have to be adjusted as to decimal.

If, for example, we use aluminum 2-in. square, we intersect L at approximately 8.35. In this case D^2 (4) can be used directly on S scale and reading directly on W (revised) we have 4.86 or 4.87 lb per ft. This brings up another error, one of relative positions of the scales. Of course, at 10 lb per cu in., 48 cu in. of aluminum should read exactly 4.8 lb per ft. It may be due to distortion in the reproduction processes, but the top of scale S is above the level of W and L. Since scale S is exponential, in this case to the second power, the numbers on S should be in line with and represent the square of the numbers on W and L. (Not true value, of course.) For example, 4 on W and L should be at same level and cross S at 1.6, or 3 on W and L should cross S at 0.9. If you'll check you'll see that these two sets are off in opposite directions.

ALBERT J JACKSON, *Engineer*
The Cameron & Barkley Co
Jacksonville, Fla.

. . . How about running an accuracy check on your nomograph? If it's correct, will you please tell me how you use it?

S A TAYLOR
Fairbanks, Alaska

EDITOR'S NOTE: POWER *goofed in not picking up the error. Reader Taylor (and others who raised a questioning pen—or eyebrow) will note that Reader Jackson sets us straight in no uncertain fashion.*

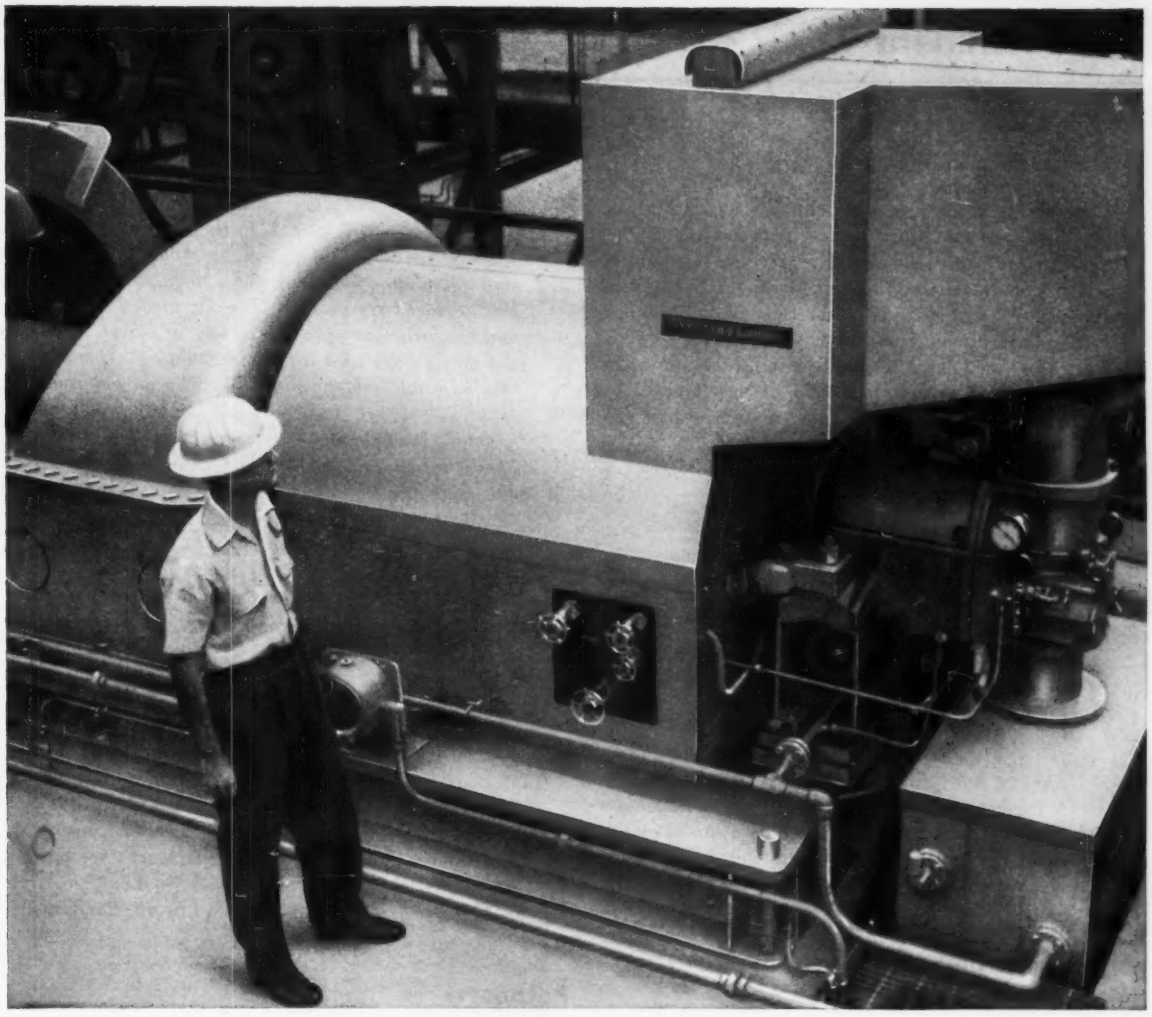
Listless? Irritable? Is system blocked?

Referring to Mr McNally's dilemma, (*What would you have done?*, July, p 201) some ammonia compressors have a safety valve located on each cylinder to relieve discharge gas from high side to low side in case the compressor is accidentally started with the discharge valve closed. The short-circuited gas will make a noise or set up vibration indicating something is not as it should be.

Probably one of the best ways to check for obstructions in a compressor discharge line is to locate a pressure gage at the condenser. This gage, compared with discharge pressure gage at the compressor, will indicate any pressure drop in the line. Similarly, a pressure gage at the receiver will show any pressure drop between condenser and receiver. In situations such as described by McNally this pressure-gage setup will pinpoint the trouble.

Speaking of pressure loss, let's not overlook the suction-line strainers which protect the compressor against damage from entrained solids. As strainer collects foreign matter its reduced effective area may result in a significant pressure drop at compressor suction inlet.

A relatively simple method to permit periodic checks of strainer without removing it is a pressure gage located in a valved bypass around the strainer. With downstream valve open, upstream



Westinghouse multi-stage, hi-speed turbines guarantee you

...engineered power to meet your exact needs

Why pay for power you can't use? Or, by the same token, why strain a machine beyond its capability? Westinghouse can meet your exact turbine requirements with the world's broadest line of wheel sizes and design capabilities for steam conditions through 2400 psig—1050° F at the throttle, exhausting from 1 in.hg absolute to 300 psig.*

Fitting the right wheel size to the job is the key to efficiency and economy. By knowing your process requirements, cost of steam and number of hours you expect your turbine to run during the "payoff" period, we can provide the turbine design best suited to your power and economic requirements.

To meet these varied requirements, Westinghouse has available five frame sizes of multi-stage, hi-speed turbines with wheel diameters ranging from 12 in. to 32 in. In addition, interchangeability of many wearing parts saves you money on inventories and stocking of spare parts.

Westinghouse turbine specialists located throughout the country are available at all times to provide personal attention to your heat balance problems, and are equipped to offer on-the-spot price and performance data for this entire turbine line. The capabilities of the world's largest and most modern small turbine facility are at your disposal. Call your Westinghouse representative, or write Westinghouse Electric Corporation, Small Turbine Sales, Lester Branch Post Office, Philadelphia 13, Pennsylvania. J-50605

***WESTINGHOUSE MULTI-STAGE, MULTI-VALVE, HI-SPEED TURBINE FRAME CAPABILITIES**

Turbine Frame	M-12	M-16	M-20	M-25	M-32
Number of Stages			As Required		
Wheel Size, in.	12½	16	20	25	32
Maximum hp	4000	5000	7000	10,000	16,000
Maximum rpm	16,000	12,500	10,000	8000	6000
Maximum P_1, psig	1500	1500	1500	1500	1500
Maximum T_1, °FIT	950	950	950	950	950
Maximum P_2, psig	300	300	300	300	50
Exhaust Size, in.	20	24	30	36	48
D. F. Exh. Size, in.	30	36	48	42 x 64½	48 x 84
Max. Inlet Size, in.	5	6	8	10	12

(For special applications, inlet steam conditions to 2400 psig, 1050° F total temperature can be accommodated.)

YOU CAN BE SURE...IF IT'S

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valve closed, gage shows pressure at strainer inlet. Reversing procedure, gage will show pressure drop, if any, between strainer and compressor.

Any pressure loss existing between evaporator and compressor suction inlet reduces compressor capacity and increases power consumption per ton of refrigeration. Number of pounds of gas a compressor can handle per unit of time determines its refrigerating capacity. Weight of gas handled by any given compressor depends upon absolute suction pressure and compressor's efficiency.

C T BAKER, *Atlanta, Ga.*

Hole that line

. . . I've been a subscriber to your excellent magazine for some 13 years. Idea of perforated pages was a good one.

J W BRAITHWAITE, *Toledo, Ohio*

. . . I vote in favor of the tear-out scheme.

STEPHEN KIEDROWSKI, *Milwaukee, Wis.*

. . . I concur with C W Mathews (*Comment,* June, p 98). Perforation of the pages is a mistake (unless, of course, the journal is intended for a purpose other than reading).

W R AHERN
H Platt & Associates, Consulting Eng'rs
Brisbane, Australia

Marmy lowers the diesel—and the boom

At a recent engineering society meeting several of us got together for lunch. During the small talk we discussed the exploits of a guy who can think faster on his feet than anyone in the business—one Marmaduke Surfaceblow. Someone recalled the story about Marmy's hydraulic jack, published back in April, 1958. The guy's opinion was that the story was a fluke. Come to think of it, I, too, would like to see anyone lower a large diesel engine by letting ice blocks melt under it.

J M GORRIE, *Cleveland, Ohio*

. . . I'm sure you'll be interested in the enclosed clipping. I thought this was Marmaduke's own invention.

G ROSEKILLY, *San Mateo, Calif.*

EDITOR'S NOTE: *Clipping forwarded by Reader Rosekilly is from the New Glasgow, Nova Scotia* Free Lance, *Thursday, June 4th, 1959. We quote:*

"Cool thinking by contractors Duane Carter and Leslie Leach helped them move a large feed store. They needed 20 jacks to support the structure while they removed large beams from the underside before dropping the store on new foundation. They didn't have enough jacks. So they bought fourteen 100-lb chunks of ice, put the ice on the concrete slab foundation, lowered the structure on the ice and removed the beams. The ice melted Tuesday and the structure settled precisely in place. Where did they get the idea for the ice? Carter explained: 'My wife told me she saw it done in an old comic strip'."

Oddly enough, the letters from Readers Gorrie and Rosekilly came in less than a week apart. Steve Elonka approached the salty old consulting engineer with letters and clipping.

Snorted Marmy: "Bilgewater on guys who can't think for themselves. And where do you lamebrains think that funnypaper joker got the idea?"

. . . The amateur shovel hog-head should have known enough to check height of his smokestack, boom and dipper sticks before trying to pass under the trolley wires.

Here in California the power companies continuously issue safety bulletins calling attention to the danger involved in taking derricks, traveling cranes, trucks with high loads, etc, under transmission lines. But some people never learn; we have a number of such accidents each year.

H T LIVINGSTON, *Los Angeles, Calif.*

Potpourri

. . . "*My biggest boner*" was tremendously interesting (*Practical ideas,* August, p 200). If Mr Evans had done that in our 138-kv substation he wouldn't have been around afterward to tell us about it. I'd like to suggest that all switching procedures be included in an operations manual and the manual be made available to substation operators. If Evans had had such a manual, he'd have known that the line, main and transfer disconnects must be open.

Further, it's necessary to ground the tops of the breaker bushings even when the breaker is open to bleed off the static charge.

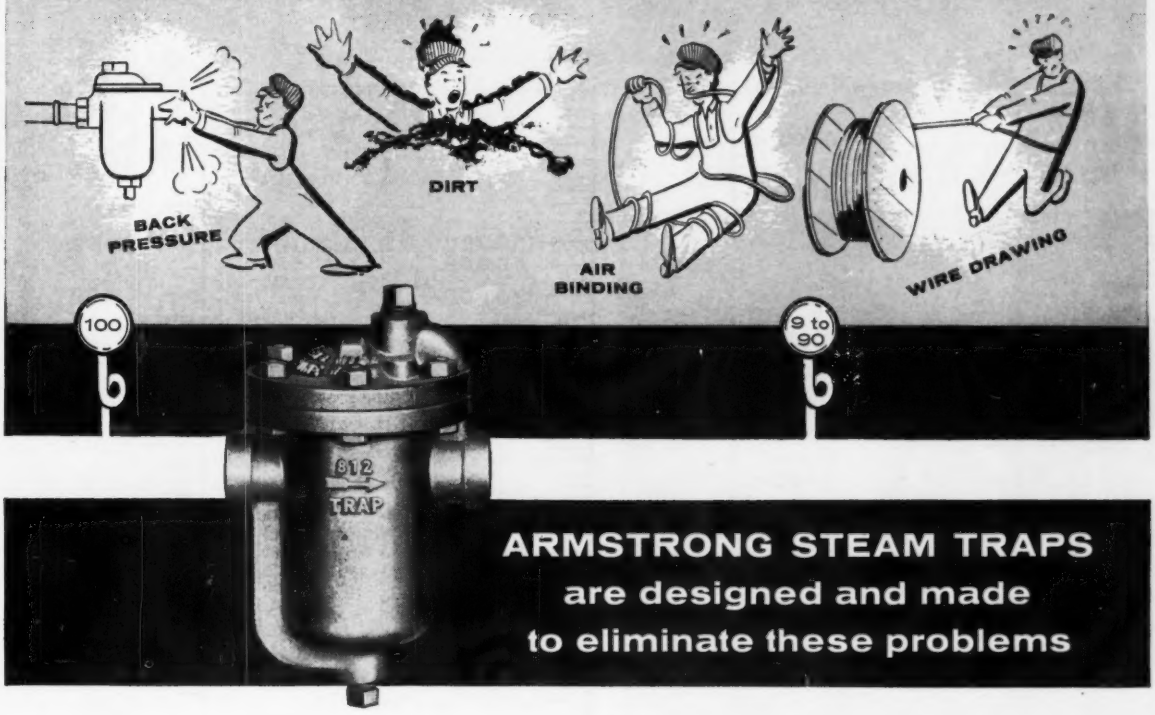
F PAULITZ, *Electrical Operations Supervisor*
Toronto Power Plant, Ohio Edison Co

. . . As usual, George Edwards comes up with an interesting and informative story. Dr Helmut Sopp was, and is, absolutely right. (*George Edwards,* July, p 180).

Some personnel management have yet to learn that employees are individuals, not puppets or machines. When this fact is realized, more plants will see their employee outage curves drop sharply.

CLYDE G HOWARTER, *Canton, Ill.*

Have you ever been troubled by any of these steam trap problems?



ARMSTRONG STEAM TRAPS are designed and made to eliminate these problems

BACK PRESSURE . . . Armstrong Traps operate on any back pressure—or vacuum, for that matter. As long as there is a pressure differential across the trap, it will close on steam and open for condensate. Even the high back pressure caused by blow through of one or more traps in the system will not disturb Armstrong Traps. Other than a reduction in capacity, Armstrong Traps are unaffected by back pressure.

DIRT . . . Armstrong Traps are not affected by ordinary dirt. When the trap opens condensate swirls down under the edge of the bucket and up through the discharge orifice. Dirt is kept in suspension and discharged along with the condensate. For very bad dirt conditions, Armstrong offers traps with integral strainers. These cost less than a trap plus a separate strainer.

AIR BINDING . . . Armstrong Traps cannot air bind. Air in the system passes through a vent in the top of the bucket. It collects in the top of the trap and is discharged with the condensate. There is no chance for it to stop the trap. For low pressure on-and-off units where large amounts of air accumulate while the steam is off, Armstrong offers open float and thermostatic air vent traps in a complete range of sizes.

WIRE DRAWING . . . Armstrong Traps are designed and made to resist wire drawing. The valve and seat are tough stainless steel. The valve opens and closes tightly with a fast action and is always water sealed. There is virtually no chance for grit or sediment to lodge in the valve, virtually no chance to create conditions that lead to wire drawing.

There's no need to accept any of these problems as "inevitable." Your local Armstrong Representative can show you how to end them all. Call him today or write direct.

860 Series for low pressure heating service.

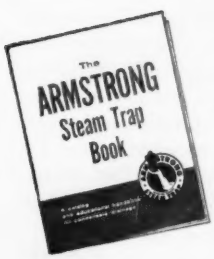
800 Series, side inlet, side outlet.

No. 801, side inlet, bottom outlet.

880 Series, integral strainer.

200 Series, bottom inlet, top outlet.

Forged Steel Series for high pressures, high temperatures.



The 48 page Armstrong Steam Trap Book tells how to correctly size, install and maintain steam traps for any pressure, any temperature, any load plus full catalog data on Armstrong Steam Traps. Ask for Catalog K.

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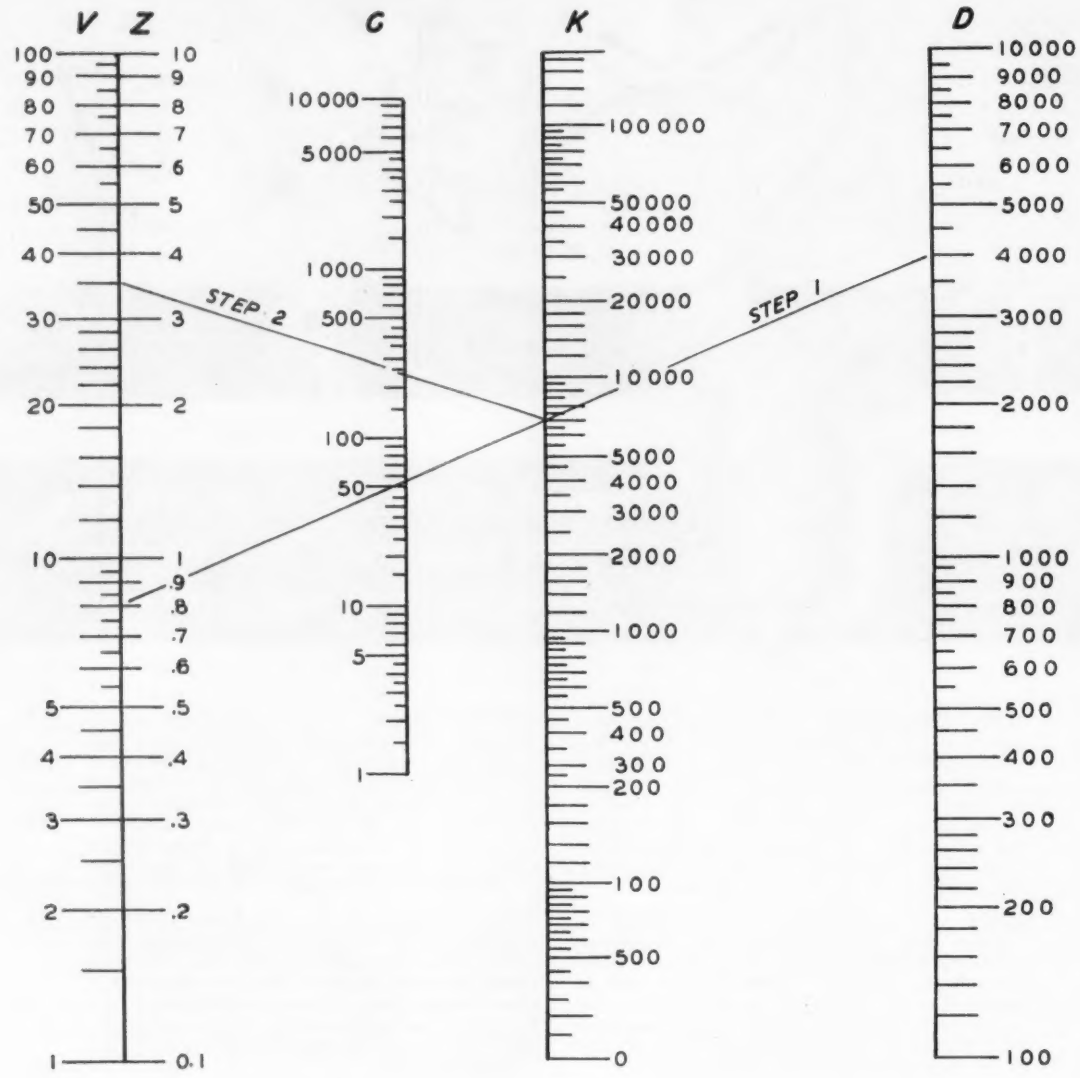
See our Catalog in Sweet's Plant Engineering File.

For more facts circle 246 on Reader Service card, p 101

Power's data sheet

NO. 327



Estimating electrical power costs for radiant heating

Conventional methods of estimating electrical consumption for radiant panel heating often go astray through using a straight conversion from Btu delivered by conventional heat to kwhr. Resulting kwhr estimates are up to three times actual power needs.

Nomogram is based on formula $C = 0.2VDZ/1000$ where C = cost for the season's heating in dollars, V = room volume plotted as thousands of cu ft, D = degree-days per heating season, and Z = cost per kwhr, plotted as cents per kwhr. For example: plant with 8000-cu-ft room will be heated during 4000 degree-day season. To find kwhr consumed draw straight line from 8 on V to 4000 on D. Intersection with K shows season consumption of 7000 kwhr. Line from intersection of K to 3.5c per kwhr on Z crosses C at $240. This is electricity cost for season.

S Salva, *Jackson, Mich.*

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News and Notes on...

Good Packing Practice

JOHNS-MANVILLE JM PRODUCTS

Maintenance and Design Hints from Johns-Manville Packings and Textiles Dept.

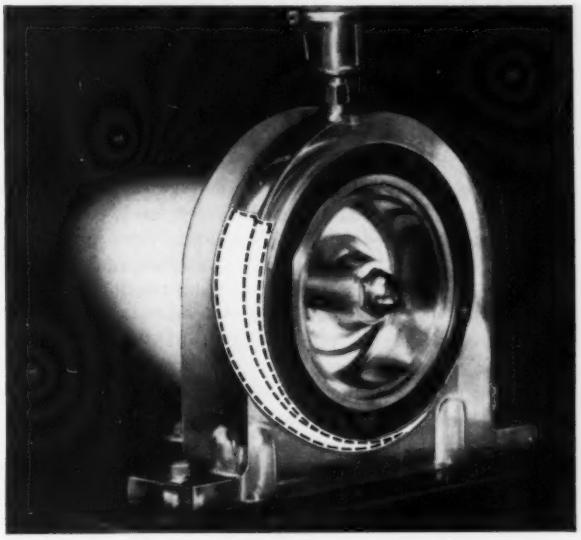
Subject of the month: Effective Shaft Sealing

Question: What is an economical way to seal in or seal out with maximum efficiency?

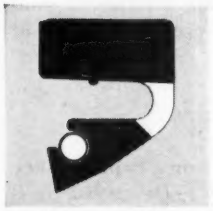
Whether the shaft bearing is of the sleeve, roller, or ball type . . . seals should meet two basic requirements: (1) provide a tight seal despite light applied pressure, and (2) resist abrasion and corrosion.

The transparent unit shown at the right was created by research engineers to study this subject of effective sealing . . . witness the performance of J-M seals in development stages. It helped them perfect the versatile, dependable line of J-M Clipper® Seals that serve many industries.

In this unit, Clipper Seals are mounted on a transparent cylinder, just as in a bearing cavity. The heel of the seal provides the rigidity essential for a press fit. The lip is flexible and soft so as to snug the shaft with a minimum of friction. Thus it acts like a gasket and effectively stops leakage.



HERE ARE JOB-TESTED RECOMMENDATIONS FOR COMMON SEALING APPLICATIONS:

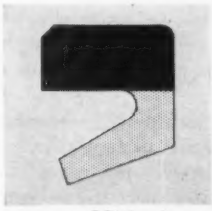


For General Service—Type LPD All Purpose. This line-contact Clipper Seal provides long life and maximum sealing effectiveness under a wide range of equipment variables. Its synthetic rubber base compound is recommended by J-M for most sealing lip applications where combined ambient and operating temperatures reach 250°F and higher. It seals practically all fluids . . . has proved highly effective against oils and greases, hot and cold water, air and many other gases and vapors. And it maintains its high efficiency despite time, high temperatures, and adverse conditions.

For Small Clearances—Split Clipper Seals. Split Clipper Seals have wide acceptance as temporary replacement seals for equipment with space or design limitations . . . to save costly downtime. Installation in inaccessible space is relatively simple and speedy. They are practically fracture-proof . . . stand up under the rough treatment . . . can be forced into position around the shaft. They give long-term, efficient sealing until a major overhaul permits replacement with solid seals.

For further data on Clipper Seals write for Book PK-71A. Address: Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario.

For Continuous High Speed Operations—Type LPD Metal-Reinforced. This Clipper Seal, incorporating a metal reinforcement, is ideal for use in continuous high speed and extremely abusive service such as encountered in the steel industry. It expands and contracts with the chuck in which it is installed. It is a combination of two synthetic rubber base materials that are highly resistant to cracking, hardening and shrinking.



For Small Shaft Diameters—Type SS Springless. Here's the Clipper Seal designed for smaller cavities. It is made of a selected synthetic rubber base compounded to minimize swell and deterioration in corrosive applications where chlorinated solvents, lubricating oils carrying severe additives, or similar aggressive fluids must be sealed. It is a complete part in itself—contains no metal spring. No spring is required because this seal is designed to exert sufficient lip interference on the shaft to compensate for wear over a long period of time.

JOHNS-MANVILLE

For more facts circle 247 on Reader Service card, p 101

Technical briefs . . . Latest engineering

Water-treatment progress accelerates; management takes a hard look at water conservation

Twenty years of progress in ion exchange, *W S Morrison and Joseph Thompson, Illinois Water Treatment Company*

Twenty years ago, water treatment by ion-exchange methods meant using zeolite softeners. The operator needed to know only flow rates and recommended bed depths for greensand and siliceous gels. Today, a wide variety of exchangers is available to meet every special water-treatment need.

The ten most significant developments over the past 20 years are reviewed in detail. Some of these are organic cation and basic anion resins, mixed-bed deionization, counter-flow regeneration and high-flow-rate ion exchangers.

Reduction in plant size has made startling progress. Where several hundred sq ft were required for a fixed-bed plant 20 years ago, today's equivalent-capacity plant may only require 15 sq ft. Automatic backwash, regeneration and rinse are now realities. Operational cycle can be actuated by pushbutton or by an impulse from a flowmeter or conductivity instrument. *20th Annual Water Conference—1959*

Water management in industry, *K S Watson, General Electric Company*

Conservation through water-management programs in industry can produce surprising savings. Many possible steps are simple and inexpensive—such as metering to indicate areas of waste. Metering will show flows which aren't needed during off-production hours.

Many other more complex methods of water management are available to industry: recirculation, multiple usage and in-plant reconditioning with cooling ponds or towers.

A study of in-plant vs municipal sources often indicates annual savings which will retire the cost of conversion equipment in a very few years. Especially in areas of acute water shortage, the community-relation benefits of releasing water for public use cannot be overlooked.

Waste treatment is frequently a vital part of a good water-management program. It permits re-use of previously wasted effluents.

Several specific examples of programs carried out at General Electric illustrate annual savings that accrued. Tables show relative costs of in-plant and public water sources. *ASME paper 59-SA-57*

Industrial water: use, re-use, misuse? *Everett P Partridge, Hagan Chemicals and Controls, Inc*

Laws controlling our national water resources have evolved in all jurisdictions, local, state and national. In many cases they are based on British Common Law. This has produced a bewildering situation for industry, one of the largest users of water. Custom has placed industry last on the priority list with the public and agriculture above it, yet of these three groups, industry returns to the available supply in usable form the highest percentage of the water it takes.

Profit motive sometimes makes it difficult for industry to voluntarily treat its effluent for maximum re-use. Frequently it is necessary for a public authority to insist on adequate waste treatment. It may become necessary for industry to take the initiative in this area to improve its priority position in the public mind and receive proper consideration in water allocation.

Possible economies are illustrated using the Fontana Plant of Kaiser Steel as an example. While usual water requirements in the steel industry amount to about 65,000 gal per ton of steel, Fontana consumes only 1400 gal per ton of steel. This outstanding reduction in water requirement is accomplished through maximum re-use of partially contaminated effluents and concentration of contaminating agents in the least possible quantity of water. *ASME paper 59-SA-60*

Steam generators

Some design features of the Meramec twin-furnace reheat steam generator, *M F Dallen and D R Stewart, Foster Wheeler Corporation*

Meramec 3 steam generator is of the twin-furnace type. It has a rated capacity of 1,850,000 lb per hr at 2150 psig/1010 F/1010 F. Heat release is 78,000 Btu per hr per sq ft.

Superheater is of combined radiant and convection type to avoid high furnace exit temperatures and satisfy the fuel characteristics, particularly slagging properties of the ash. Bias firing between the two furnaces controls reheat temperatures.

Primary steam-temperature control is achieved with condenser type heat exchangers located in the inlet radiant superheaters of each furnace. Control and operation of these heat exchangers is discussed.

In addition, superheater metals, natural circulation, and flue, gas and air systems are covered in detail. *ASME paper 59-SA-63*

Application of cyclone-furnace firing to industrial boilers, *C T Smith, The Babcock and Wilcox Co*

Cyclone-furnace firing may offer many advantages

to industrial users whose unit steam-generating capacity lies between 100,000 and 500,000 lb per hr.

Construction details and furnace operation for industrial users are reviewed. Advantages include: (1) ability to burn a wide range of coals (2) rapid and safe multifuel selection (3) flexible and simplified operation (4) lower overall maintenance costs (5) less space required and (6) fewer foundation and electrical connections. These and other aspects of cyclone-furnace firing are discussed. Specific examples include a brief historical sketch of several installations. *ASME paper 59-SA-53*

Gas recirculation and its relation to boiler design and operation, *J D Andrew Jr, A M Frendberg and P H Koch, The Babcock and Wilcox Company*
Gas recirculation can be used to control both outlet steam temperature and gas temperatures within the furnace and convection superheaters and reheater.

Under light load conditions, proper outlet steam temperatures can be maintained by recirculating up to 50% of the stack gases. At full load, furnace gas-outlet temperature can be reduced. So a high rate of heat absorption at relatively low temperature can occur in the convection superheater and reheater, greatly easing problems with materials, ash fouling and corrosion of tube surfaces.

Today's higher boiler ratings require a higher percentage of heat absorption in convection superheaters and reheaters. Control of gas temperature in the furnace produces greater flexibility in boiler operation. *American Power Conference—1959*

Plant operation

Minimum recommended protection for unit-connected steam stations, *AIEE Working Group*
Increased popularity of the unit-connected steam station requires a critical re-examination of protective devices employed. First step in the approach to this problem is determination of elements and their position and priority in the protection system.

Overall protective schemes, considered by the working group to be a minimum, cover: (1) steam generator (2) steam turbine (3) generator (4) main transformers and (5) auxiliary systems.

Second step in the approach to this problem will be a detailed investigation of interlocking and control elements. *AIEE paper CP-59-878*

Low-cost provisions for synchronous-condenser operation of new Willow Island Unit No. 2, *R D Brown, Monongahela Power Company and A C Kelsall, Sanderson and Porter Engineers*
Equipment already installed in Unit 1 of Willow Island Station permits convenient use of the new 165,000-kw generator as an emergency synchronous condenser. This operation will improve system performance when Unit 2 is down for maintenance. Scheduled outages can be planned to remove and later reconnect the generator under light system-load conditions.

Modifications to the 165,000-kw generator are slight and provide for disconnect from the turbine during operation as a synchronous condenser.

Startup uses 200-kw spare exciter to drive the 450-kw geared exciter as a dc motor up to about 900 rpm. At this speed Units 1 and 2 can be synchronized through either a 13.3-kv bus or auxiliary 4.0-kv bus.

Actual startup sequence is detailed step-by-step and all apparatus used is listed. *AIEE paper CP-59-1066*

Power-plant control-board locations and operation, *E G Norell, Sargent and Lundy Engineers*
Older steam-electric units with separate control panels for each major component (boiler, turbine, switchgear) usually required one operator per 1000-kw installed. Centralized control panels used today have cut manpower requirement to 1/3 man per 1000 kw. Requirement is being cut further through multiple-unit control rooms. Extensive use of automatic sequential startup and shutdown equipment holds promise for even more drastic reductions.

Placing of single and multiple-unit control rooms involves many considerations. Length of control lines and exposure to damage by serious component accidents must be reviewed to arrive at optimum locations.

Miniaturized gages and controls can bring panel sizes down so that they can be conveniently watched by one operator. Placing recording devices on the rear of the control panels can save even more space.

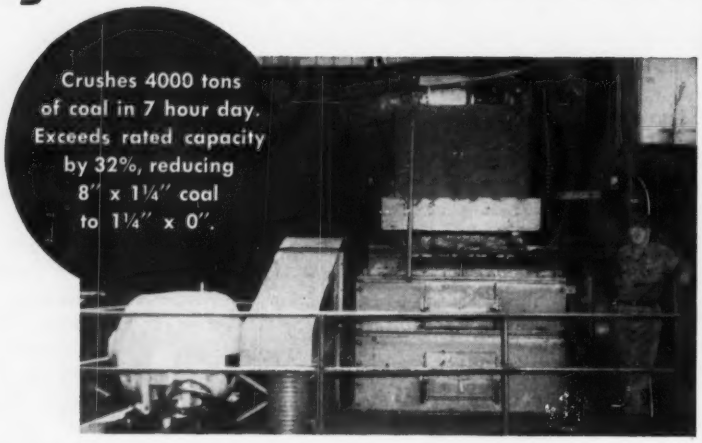
Separate startup panels for each unit with normal running control centralized seems to provide an interim step. *AIEE paper 59-877*

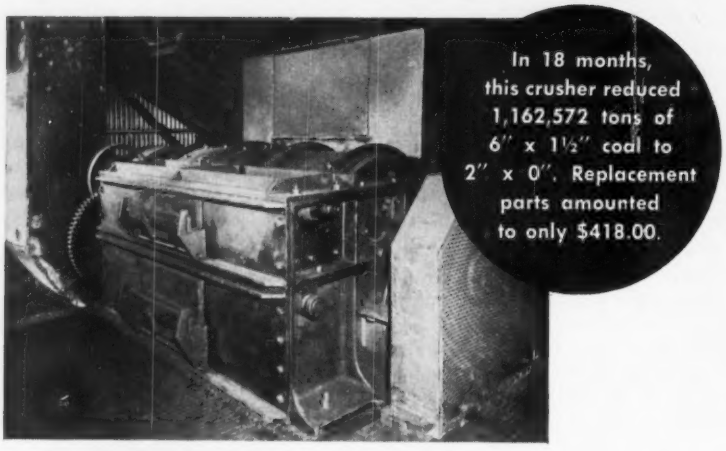
Meramec 3 steam-electric generating unit, *C H Rulfs and J K Bryan, Union Electric Company*
Meramec 3 illustrates what might be called today's typical power plant. Its 125,000-kw capacity is generated in a "kilowatt factory" without frills or features of marginal value. Preliminary studies indicated that the least-cost plant could be built with remarkably high efficiency.

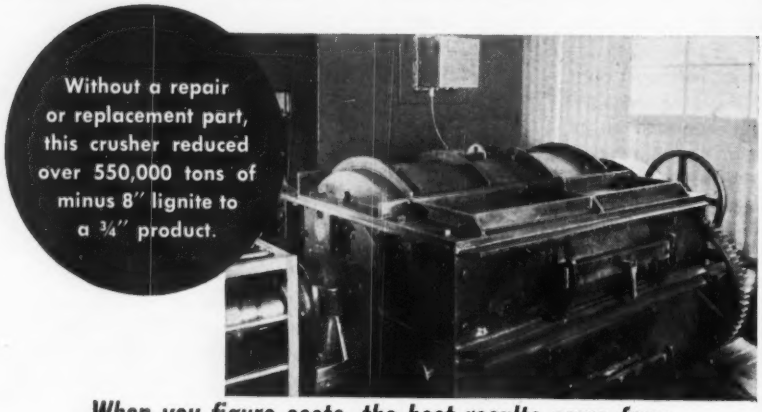
Economic analysis which prepared the ground for the present design is discussed in great detail. This includes (1) fixed charge rate (2) fuel cost (3) load factors and (4) heat rate. Plant design itself is reviewed, giving economic-engineering reasons for each element. *ASME paper 59-SA-27*

continued

CRUSHING FACTS
on *American* COAL CRUSHERS







When you figure costs, the best results come from American Rolling Ring Crushers

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Technical briefs

Begins on page 90

Steam turbines

Steam-flow distribution at the exhaust of large steam turbines, *J E Fowler and R E Brandon, General Electric Company*

Field tests on a 200,000-kw cross-compound turbine to determine distribution of steam flows at the discharge end agree with data produced by laboratory models.

Single-flow turbine tested in the field had 43-in. last-stage buckets. Two transversing rigs were specially built to give the required data. They each had five impact pressure tubes and five static pressure - measuring basket tubes. Several stationary static pressure-measuring points were included to cover regions not swept by transversing rigs.

Lab tests used several exhaust hood types tested on air. They were built to a scale providing proper Reynolds Number and Mach Number relationships. Test models used varying percentages of "advance" (distance that plane of last stage projects axially into exhaust hood).

These tests should provide a basis for improved hood designs, resulting in greater percentage of flow at close-to-average velocity. *ASME paper 59-SA-62*

Precompensating turbine-generator alignment for temperature effects on the foundation, *J L Berry, D W Crawford and R A Horine, Union Electric Company*

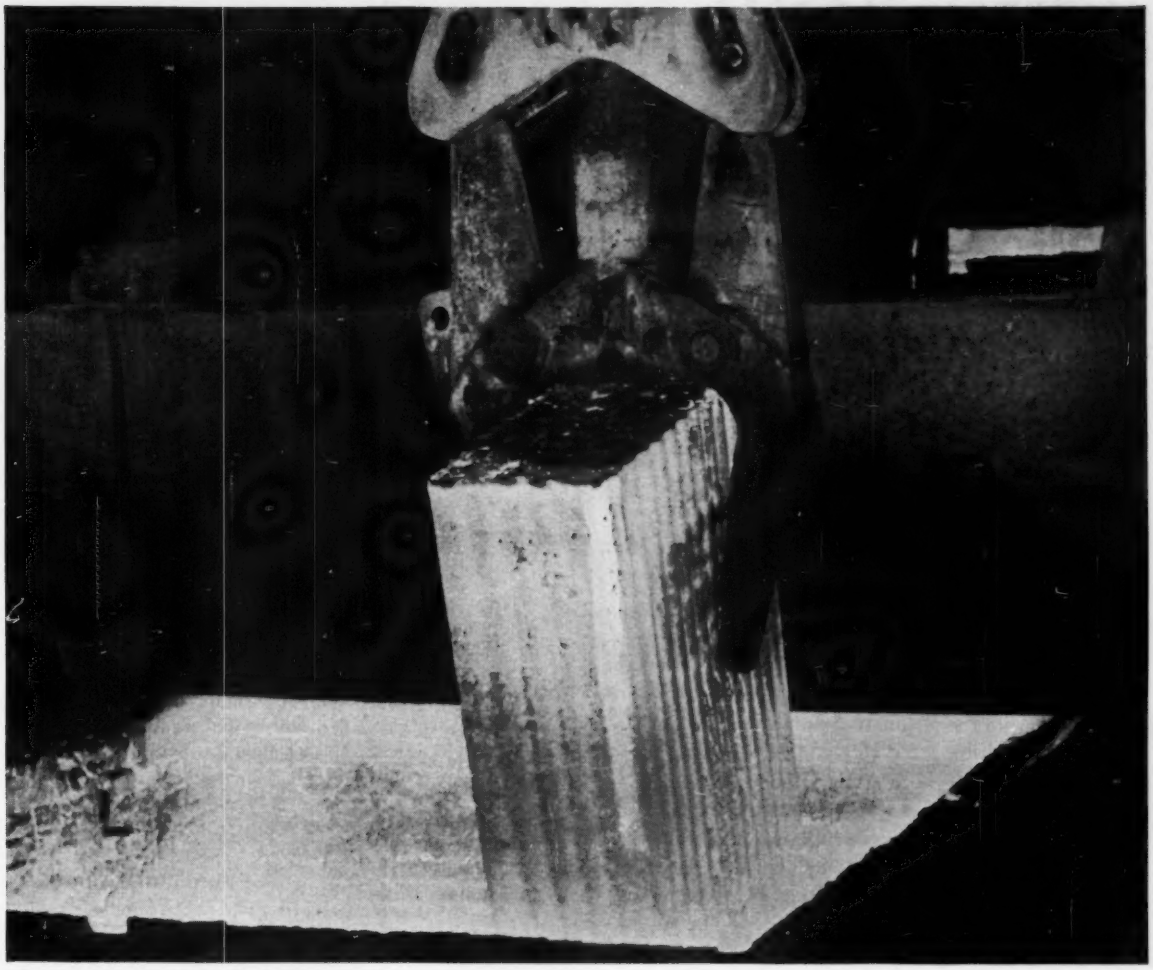
Actual operating experience with large turbine-generators indicates that cold alignment does not remain fixed when unit is brought up to temperature. Causes of hot misalignment can be (1) unequal thermal expansion of machine (2) unequal thermal expansion of foundation (3) unequal foundation settlement (4) growth or deterioration of grouting or (5) plastic deformation of foundation.

Studies show that the effects of thermal deformation can far exceed permissible coupling misalignment, so precompensated alignment is needed

Directions for ordering papers on page 98

For more facts circle 248 on Reader Service card, p 101

THE TOUGH JOBS COST LESS WITH PREMIUM LUBRICANTS



YOUR HIGH-TEMPERATURE LUBE PROBLEM was probably solved right here. Bearing temperature in these pincers approaches 1,000°F at high bearing pressure. Only Thermatex could lubricate successfully under this combination of conditions. Get the details from a Texaco Lubrication Engineer.

Here's an answer to high-temperature lubrication that you can use in your plant

Have you got a problem lubricating bearings that must run at temperatures of 500°F or more – or in ambient non-constant temperatures of 1,000°F or more? Kiln cars, perhaps? Or rollers handling hot ingots—or bearings on a roasting furnace? A new Texaco grease, Thermatex, has solved these problems, and many others, too. It probably can solve yours. Why? Because:

Thermatex is a unique new product that lubricates dependably even at temperatures of 500°F and higher—with a tough lubricating film that's proof against extremely high pressures.

In the cases we've cited, Thermatex made the whole difference between bearing service and bearing failure. If you've got a lube problem that's too hot and too heavy for any ordinary lubricant, try premium-grade Thermatex.

Thermatex is just one example of the fact that the tough jobs cost less with premium lubricants. However specialized your problem, a Texaco Lubrication Engineer can supply you with an answer. Just call the nearest of the more than 2,300 Texaco Distributing Plants, or write Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

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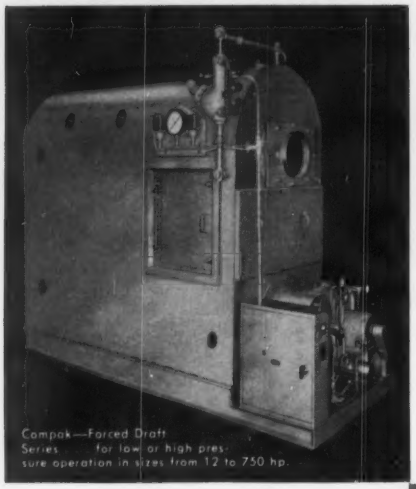
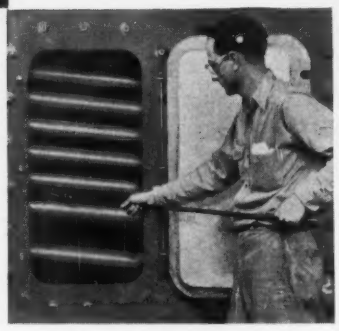
IT COSTS LESS TO OWN AN INTERNATIONAL PACKAGE BOILER



Compak—Forced Draft Series ____ for low or high pressure operation in sizes from 12 to 750 hp.

The only true cost of any boiler is the *total cost* including day-to-day operation, cleaning and maintenance. In addition to unsurpassed fuel economy, International WATER TUBE Package Boilers are the easiest to maintain—an important cost advantage.



EASIEST TO CLEAN . . .

Full access is provided to *both* the fireside and waterside of all tubes. Even when neglected for long periods, only a small deposit of soot can accumulate on *top* of the tubes, and this can be quickly brushed or blown off. Obviously, any danger of untimely shutdown due to soot clogged in tubes is eliminated. With an International Package Boiler, cleaning is an occasional, simple chore . . . not a mandatory, frequent, and costly maintenance headache.

LOWEST MAINTENANCE . . .

Because of built-in quality and International WATER TUBE design, there is no possibility of *bagging, blistering or furnace burnout.* In addition, tube ends are completely submerged in water filled headers, eliminating any chance of leaky joints due to flame impingement.

Before specifying or purchasing any Package Boiler, take a close look at the *total* cost picture. No matter how you compare, you'll see that it costs less to own and operate an International Package Boiler.

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to minimize these effects. Units in the Union Electric system are used to illustrate problems.

Authors discuss other means of minimizing thermal deformation—circulating a coolant through foundation; natural ventilation in conjunction with proper location of piping and equipment. *ASME paper 59-SA-54*

Electrical equipment

High-speed restarting and protection of large synchronous motors, *C L Phillips, General Electric Company and M H Yuen, Bechtel Corporation*

Loss of expensive catalyst due to process interruption on power failure prompted this investigation of high-speed restarting. Two utility sources exist but only one source energizes the bus. If these fail entirely, a 1.3-sec throw-over to another source is actuated, reenergizing the bus.

Circuitry and equipment involved are discussed in detail. Tests plus unscheduled emergency operation of the system have confirmed its adequacy. *AIEE paper 59-822*

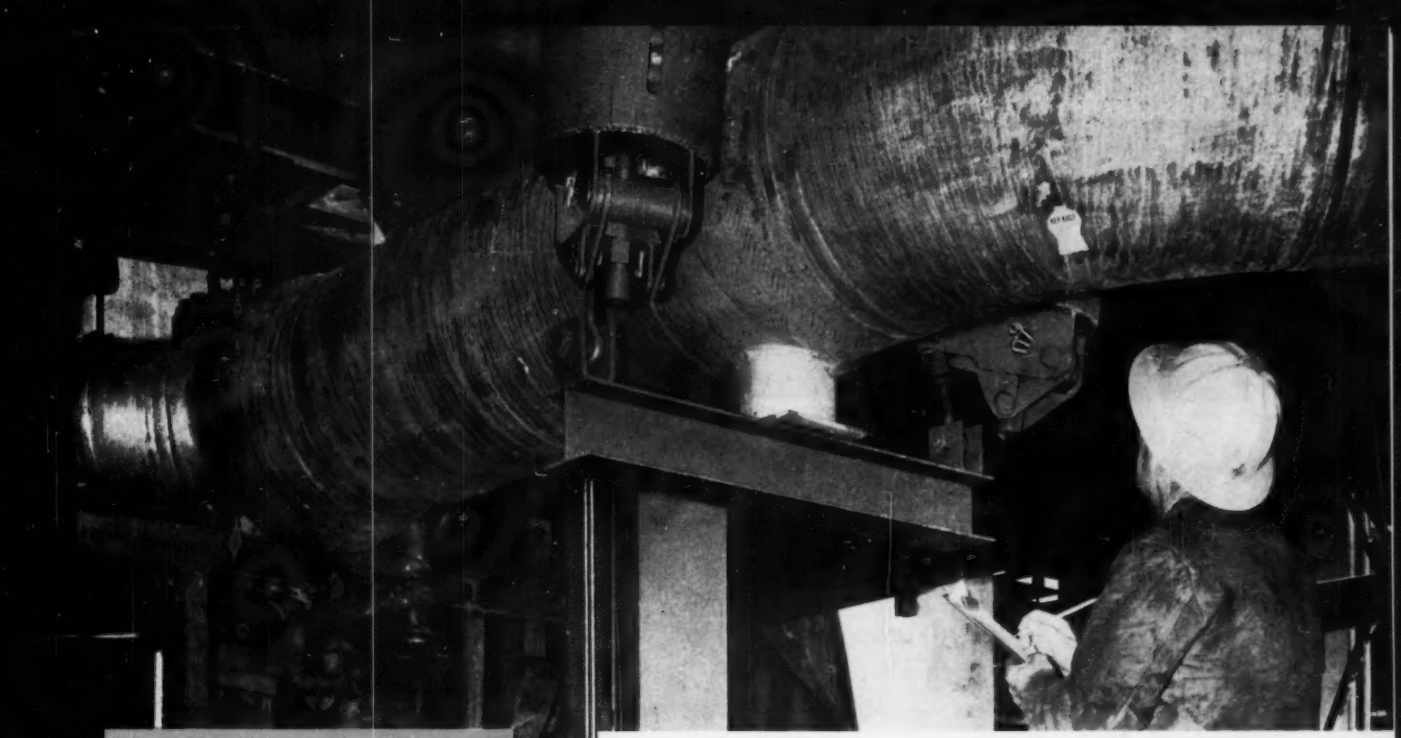
The use of aluminum conduit in industry, *H Esch, Kaiser Aluminum and Chemical Company*

Engineers familiar with use of steel conduits will recognize many of the advantages of aluminum for this service. Labor cost of installation is greatly reduced because of lighter weights. Elimination of a separate protective coating in many cases adds to ease of field assembly. Electrical advantages of aluminum conduit include ability to carry greater fault currents, nonmagnetic and nonsparking characteristics, lower dc resistance, greater effectiveness as a shield against magnetic fields.

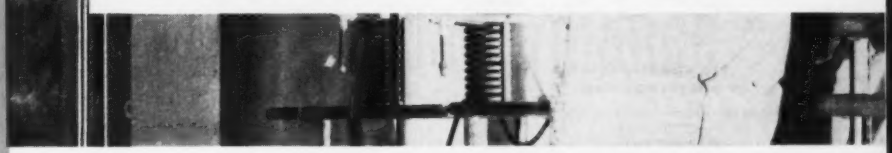
As a guide to installation, bending and threading techniques including types of machines used, types of dies, spindle speeds and cooling are discussed in detail. Support spacing can be greater due to lighter weight of aluminum conduit, saving labor and cost.

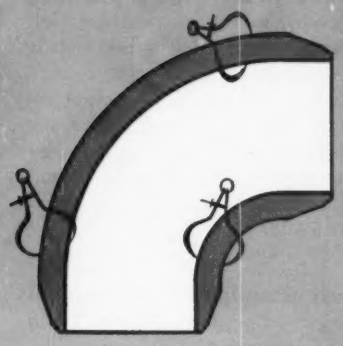
continued

Directions for ordering papers on page 98



Key-Kast 27½" elbow and wye fittings at Houston Lighting & Power Company's new Sam Bertron Power Station near the Houston Ship Channel. Designer: Ebasco Services, Inc. Engineers and Contractors: Benjamin F. Shaw Company.





Uniform Wall Elbows

Key-Kast Elbows have uniform cast steel walls approximately 15% heavier than the required minimum thickness of pipe walls of the same I.D. For extra highly stressed line sections, the wall thickness can be increased as much as desired — without sacrificing uniformity.

The flexibility of Key-Kast Elbows permits their use in piping systems based on the usual piping stress calculations. Write for engineering bulletin entitled "Key-Kast Welding Elbows in Piping Stress Calculations," and for W-K-M's Quality Control Specifications No. 102958 (conventional steam power) and No. 103058 (nuclear power).

Key-Kast Fittings can handle **any** piping job. Specify them. You'll get outstanding service.

KEY-KAST®
handles high pressure steam at new Sam Bertron power station

Key-Kast *Uniform Wall* Steel Welding Elbows are the *only* cast elbows that meet all requirements for strength *and* flexibility in this type of service, and the *only* elbows with cast steel walls of uniform thickness.

Quality controlled through the most rigid metallurgical production and testing standards, Key-Kast Fittings meet ASTM specifications, and ASME and ASA code requirements.

Call your Key-Kast representative for prompt, experienced service in selecting the Key-Kast Fitting best for you. Available in all standard shapes, sizes and schedules . . . or specially designed to meet specific conditions of pressure, temperature and lading. *W-K-M Division of ACF Industries, Incorporated, P. O. Box 2117, Houston, Texas.*

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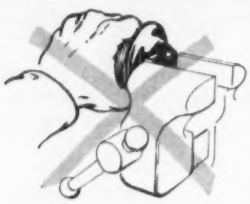
Now . . . from Barnes & Jones . . . the BIGGEST DROP in Steam Trap Maintenance in 50 Years!

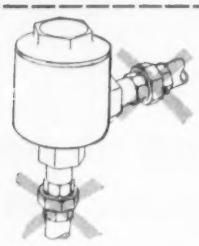
No parts — no assembly.

Barnes & Jones has been recognized for over half a century as a leader in thermostatic traps for the heating trade. Now — the same basic cage unit feature that revolutionized radiator traps thirty years ago is available for high pressure process steam applications.



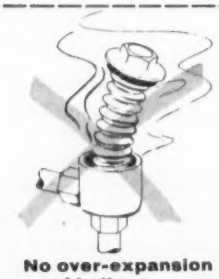
No special tools or shop required.

Now — costly, time-consuming steam trap repairs are outmoded. For with this new B-J Cage Unit replacement, you simply drop a complete new interior into the trap and it's new again. And if steam trap maintenance is a bugaboo with you — it's the best and biggest drop you can make.



No need of unions.

Also — Barnes & Jones Cage Unit interiors are available to renew other makes of industrial traps.



No over-expansion of bellows.

If you're interested in saving steam, cutting repair and maintenance time and improving trapping efficiency, write today for "The Steam Trap Primer". You'll see the 'hows' and 'whys' of steam trap performances. And perhaps you'll see how B-J high pressure traps and cage units can end your steam trap problems.

Be Wise . . . Be Sure . . . B-J

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Boston 60, Massachusetts

Technical briefs

Begins on page 90

Corrosion problems of aluminum conduit are covered, including use with steel components and when imbedded in concrete. *AIEE paper CP-59-769*

Miscellaneous

Cathodic protection applications at the Hanford Works, *C S Bucholz, General Electric Company*
Need for cathodic protection was demonstrated in the connecting piping between the original separations plants installed in 1943. By 1947, these 18-8 lines of 1- to 4-in. nominal diameter had shown several leaks.

Methods of providing cathodic protection in piping and concrete casements laid since 1947 are discussed. Also covered are cathodic protection in elevated water-storage tanks, cooling-water retention basins and reactor containment vessels.

Studies of cathodic-protection results in square vessels revealed desirability of placing additional anodes where justified, to increase current flow to these corner areas. *AIEE paper 59-821*

Injection equipment for residual fuels, *P G Burman, American Bosch Arma Corporation*
The use of residual fuels in medium-speed large diesel engines is not new. But newer engines designed for lower-viscosity fuels have refinements not compatible with residual-fuel operation.

Tests show that while peak pressure at the injection pump was 300 to 800 psi higher with residual fuels, nozzle pressure was 250 to 400 psi lower because of pressure drop through tubing.

Operating difficulties can frequently be overcome by improvements in injection equipment. Modifications such as increased clearance of the lapped parts, use of heat- and corrosion-resistant steels and reduction of parasitic volumes in passages subject to injection pressure can greatly improve engine operation. *ASME paper 59-SA-56*

continued

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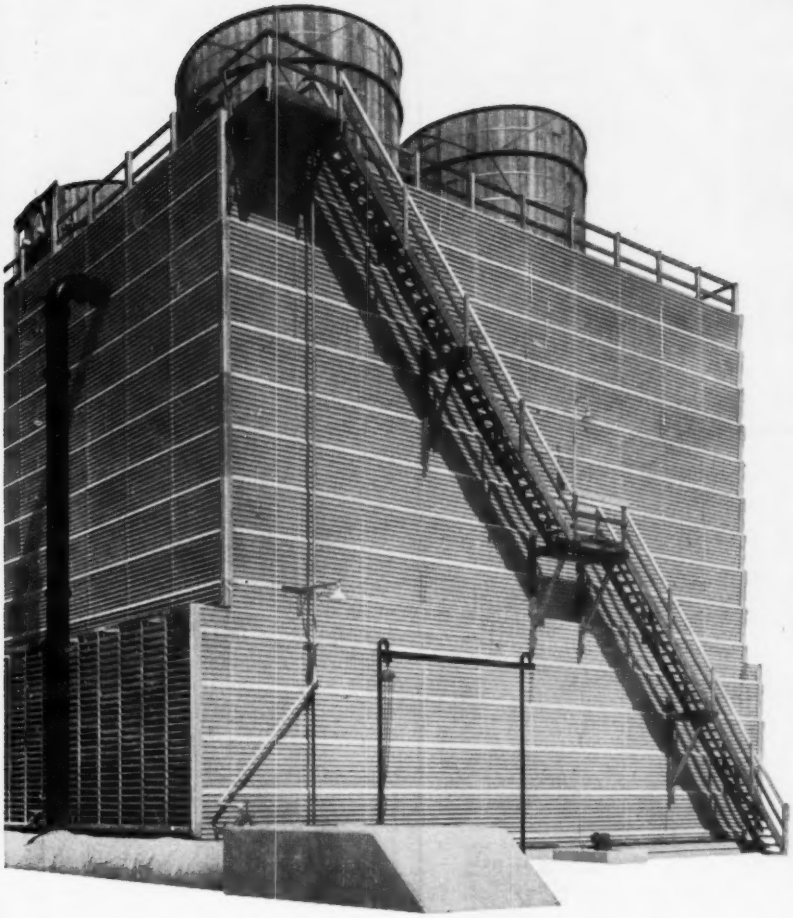

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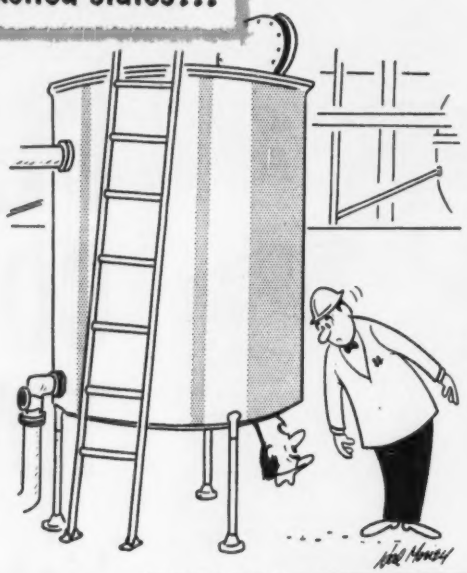
Life in these excited states...



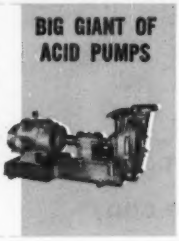
"I think I've found the leak, chief!"

A safer way to stick your neck out

Good equipment costs so *little* more, it pays to stick your neck out and ask for it. If the boss is cost conscious you'll *get* it. He too knows the dollars lost by corrosion and contamination. You're always safe when you specify Ace piping, valves, pumps and tanks.

Ace chemical-resistant rubber-lined steel pipe best for high-pressure, big sizes, or abrasives. Pipe, fittings and valves 1½ to 24".

Highly efficient *WE* pump. Capacity to 360 gpm. Cast iron, fully protected by top quality, chemical resistant hard rubber lining.



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ACE processing equipment of rubber and plastics

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Technical briefs

Begins on page 90

A new search for criteria of equipment reliability evaluation, *I J Karassik, Worthington Corp*
Classification of equipment failure into (1) infant mortality (2) random failure and (3) ultimate wear-out simplifies the approach to this continuing problem. Of the three, infant mortality is chosen for detailed discussion. Boiler-feed pumps are used as the example.

Infant mortality is the group of failures occurring early in the operating life of the equipment. It can usually be attributed to faulty design, faulty components, faulty installation, improper operating procedures or unfavorable external circumstances.

Reduction of infant-mortality failures is responsibility of both equipment designer and user's engineers and operating force. Due care and improved communication, if exercised by all involved, can greatly reduce equipment failures in this area. *ASME paper 59-SA-2*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the following sources. Order complete paper from source, not POWER.

American Society of Mechanical Engineers (ASME). Contact ASME, 29 W 39th St, New York 18, N. Y.

American Institute of Electrical Engineers (AIEE). Contact AIEE, 33 W 39th St, New York 18, N. Y.

American Power Conference (APC). Papers will be published in book form. Contact Illinois Institute of Technology, Technology Center, Chicago 16, Ill.

20th Annual Water Conference. Papers will be published in book form. Contact The Engineers Society of Western Pennsylvania, Penn Sheraton Hotel, Pittsburgh 30, Pa.

Geodetic survey ship will use a Cleaver-Brooks 2-stage flash evaporator to produce 8000 gpd of fresh water.

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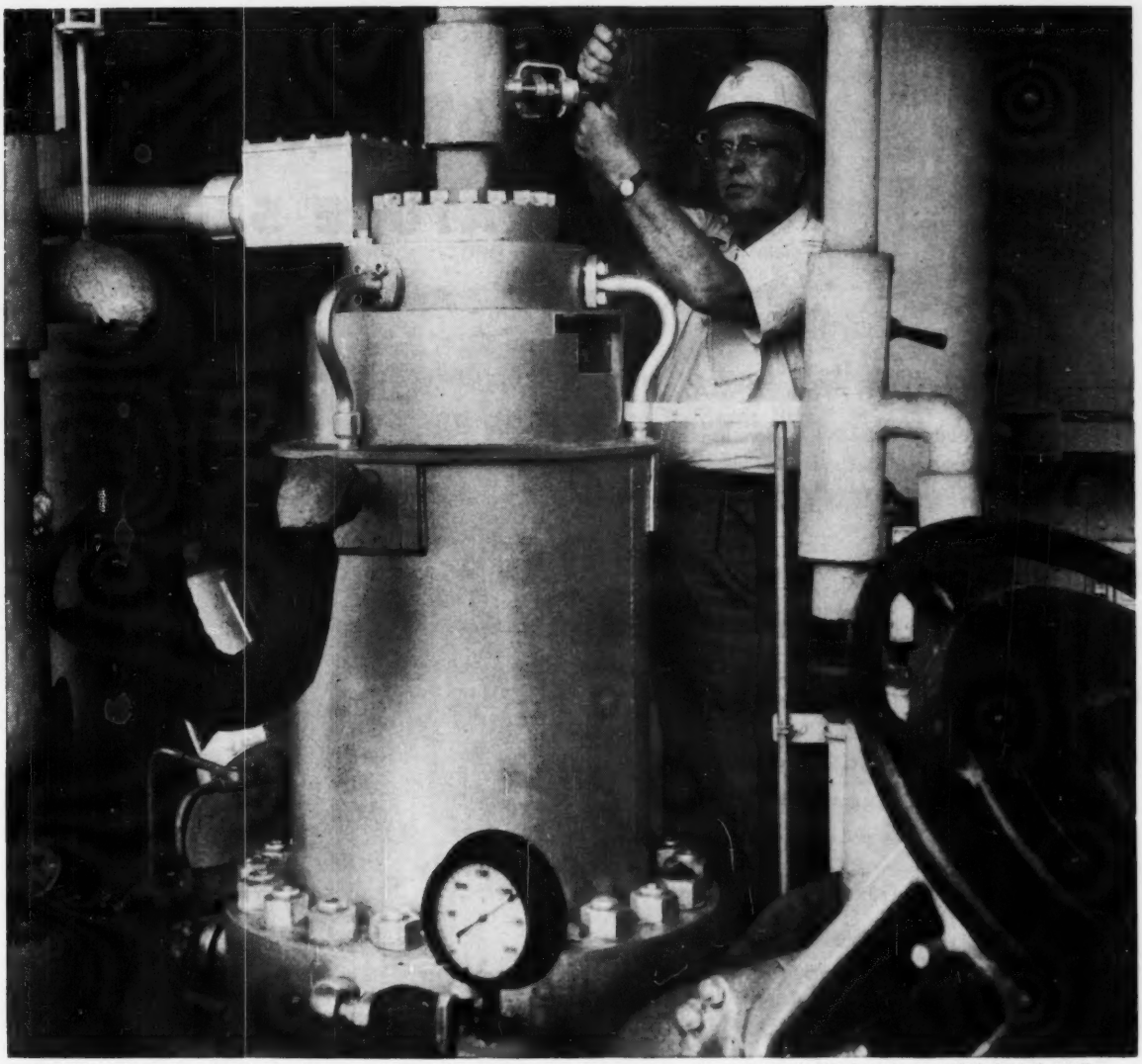

VEPCO's Yorktown No. 2 installation shows one of three 7580-gpm canned motor-pumps operating at 2120 psi, 620° F on the controlled circulation boiler.

Westinghouse canned motor-pumps installed at Yorktown and Chesterfield power stations

Operating experience with a similar installation of Westinghouse canned motor-pumps on a controlled circulation boiler at Virginia Electric Power Company's Possum Point* station led to the selection of this pump for both the new Yorktown* and Chesterfield* plants.

Proved in many utility installations, Westinghouse canned motor-pumps have a record of reliable service during long-term, continuous operations. They improve station efficiency, are easy to operate and require almost no maintenance.

- Pump and motor casings completely enclose the pump shafting, eliminating troublesome conventional shaft seals and power-consuming seal-injection systems.
- Watertight Inconel cans keep rotor and stator windings dry and trouble-free.
- Field inspection reports prove the reliability and minimum wear characteristics of water-lubricated bearings.

For full information on how Westinghouse canned motor-pumps can save you money in a controlled circulation boiler installation, contact your Westinghouse sales engineer or write: Westinghouse Electric Corporation, Atomic Equipment Department, Cheswick, Pa.

*Architect-Engineer, Stone & Webster

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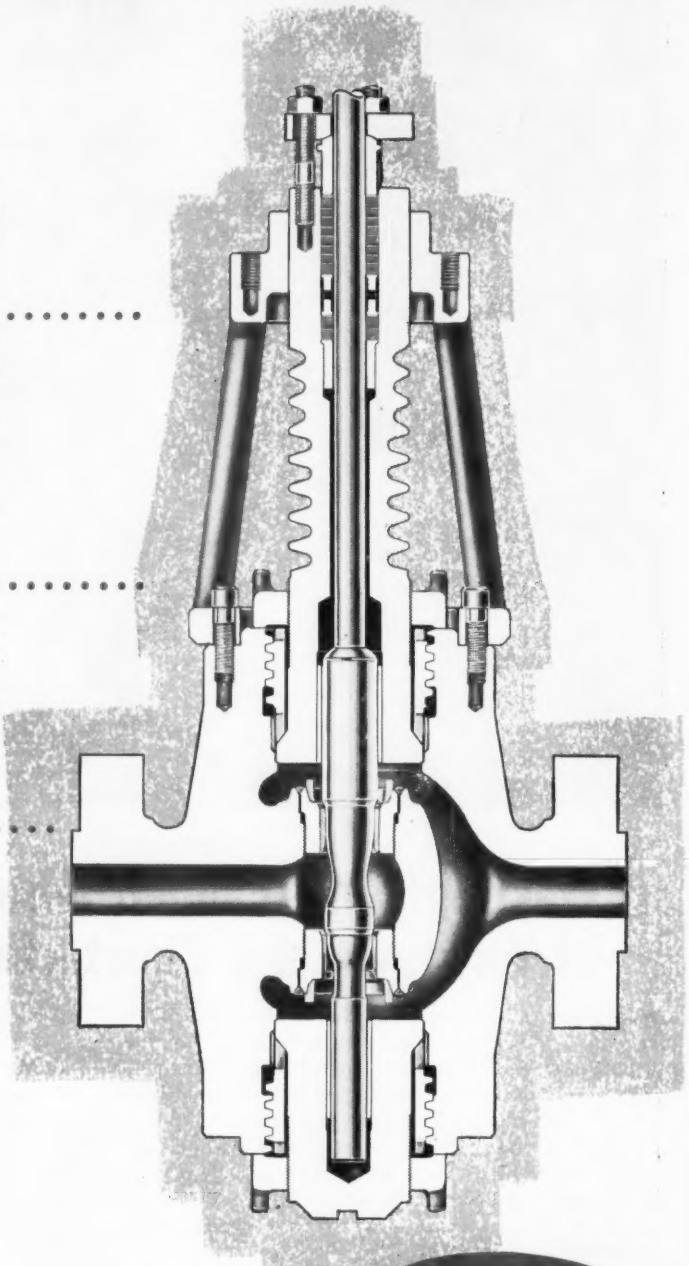

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Screwed-in seat rings are Stellite faced to eliminate erosion and wire drawing. Fisher seal welds them in place to keep rings from working loose and to prevent leakage past the threads.

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Available in single or double ported body designs—one and two inch sizes in the single ported and two, three and four inch sizes in the double ported design.

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76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

NEW LITERATURE listed in this issue, starting on p 101A

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New free literature

AIR CONDITIONING, REFRIGERATION AND VENTILATION

101 **Air conditioners** for perimeter air conditioning of multiroom buildings are discussed in 8-p bulletin 9127. Installation drawings, tables provide dimensional data. American-Standard, Industrial Div

102 **Air-sampling techniques** are topic of 4-p manual. Methods for collecting dusts and determining their count by size and weight are discussed. Gelman Instrument Company

103 **Refrigeration-system purging** is covered in 12-p illustrated bulletin 700. Armstrong Machine Works

METALS AND ALLOYS

104 **Metal-stock products** made from special aluminum-bronze alloys are described in 4-p bulletin G-51. Sizes, physical properties and applications are listed. Ampco Metal, Inc

105 **High-alloy castings** are subject of 12-p reprint. Article presents major considerations in selecting heat-resistant cast alloy and divides cast grades into three groups according to chromium and nickel content. Alloy Casting Institute

106 **Anodized aluminum grating** is introduced in new product bulletin. Illustrations of many applications of colored grating are included. Klemp Metal Grating Corporation

MATERIALS HANDLING

107 **Wire rope** varieties and applications are discussed in five 4-p new-product bulletins. Specifications for strength and size are listed in tables. Jones & Laughlin Steel Corporation

108 **Chain conveyors,** elevators are topics of new-product handbook 59127 which gives installation, operation, maintenance information. Chain Belt Company

109 **Air-vibrator applications** on bins, chutes and hoppers are featured in 4-p brochure. Specs and mounting information are given. The National Air Vibrator Co

110 **Storage-bin catalog** details bins of various sizes and capacities. American Metal Products Co

ELECTRICAL GENERATION, TRANSFORMATION, CONVERSION

111 **Ac generators,** 2 bearing, high-voltage type, are featured in product specification sheets—18 models are illustrated and detailed. Specifications and dimensions are listed. Kato Engineering Company

112 **Generators** and motors are discussed in 6-p bulletin which covers motors from 1 to 200 hp; motor-generator sets from ⅛ to 150 kw. Imperial Electric Co

113 **Motor-generator set,** fully housed, heavy-duty dc type, is announced in 2-p product specification bulletin DC459. Kato Engineering Company

114 **Transformers,** current, potential and metering types, are described in catalog S-503 Standard Transformer Company

115 **Transformer hookups** are featured in new catalog which in-

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cludes graphs for calculating correction of voltages to 115-120 and 230-240 as a quick method of determining percent of voltage correction required. Acme Electric Corporation

116 **Variable transformers,** open, enclosed, fuel, cord-plug and enclosed-terminal models are topic of 8-p bulletin P559. Ratings are 6.0 amp on constant-current loads and 9.0 amp on constant-impedance loads. Superior Electric Company

ELECTRICAL DISTRIBUTION AND PROTECTION

117 **Electrical enclosures** are topic of new bulletin. Wall - mounted, floor-stand models are shown. Machinery Electrification, Inc

118 **Overcurrent relays** are detailed with application and construction features in 16-p catalog 5-050. Inverse, very inverse and extremely inverse designs are featured. Federal Pacific Electric Company

119 **Dual connector plugs,** shielded/insulated and insulated types, are topic of product specification sheet. Superior Electric Co

120 **Automatic transfer switches** for service to 600 v, 800 amp, interrupting capacities to 50,000 amp rms are illustrated in 4-p bulletin 07500-G. "Narrow" control center model is featured. Lake Shore Electric Co

121 **High-speed circuit breakers,** current-limiting dc type, are described in 4-p bulletin S-4601-1A. Applications, ratings, dimensions and weights are included. I-T-E Circuit Breaker Co

122 **Automatic voltage regulators** featuring fully transistorized circuitry are topic of 8-p bulletin S259IET. Units come in ¼, ½ and 1 kva frame sizes for 115 v, 60 cycle ± 5% single-phase duty. The Superior Electric Co

123 **Rectifier,** heavy-duty silicon type with a rating of 250 v dc, 400 to 2000 kw is described and illustrated in 8-p bulletin. Allis-Chalmers Manufacturing Co

124 **Tube-replacement rectifiers,** h-v silicon type, are topic of specification sheet SR-209. International Rectifier Corporation

125 **Compression terminal** selection guide lists specifications of glass - to - metal hermetically sealed terminals and gives details in bulletin SCT-59-101 Philips Electronics, Inc, Electrical Industries Div

126 **Silicon power rectifiers** designed for operation at current levels from 1 to 15 amp are announced in specification sheet 71059. Syntron Company

127 **Primary unit substations** with incoming ratings of 6900 through 69,000 v and outgoing ratings of 2400 through 13,800 are featured in 4-p bulletin S-2701-1A. Sections on incoming, transformer and outgoing parts of unit subs are included. I-T-E Circuit Breaker Company

ELECTRICAL APPLICATIONS

128 **High - voltage dc power - supply** models are described in 4-p product data bulletin. Applications include dielectric testing, injection and focusing sources

November 1959 issue — This card void after February 1, 1960

Circle key numbers below for FREE information on...

PLANT EQUIPMENT in the news this month, starting on p 116

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

NEW LITERATURE listed in this issue, starting on p 101A

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150
151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175
176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200

ADVERTISED PRODUCTS appearing throughout the issue

201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225
226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250
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NEW FREE LITERATURE continued.....circle key numbers, page 101, for your copies

for nuclear particle accelerators, electrostatic precipitation and separation. Specs are given. Sorensen & Co

129 **Magnetic starters** for 15 hp, 440-550 v are introduced in 16-p catalog 14-B1. Removable fronts, dual-voltage coils reconnectable on the job, "trip-free" thermal-overload relays with trip indicator are sections included. Furnas Electric Company

130 **Adjustable-speed drives,** all-electric models with low hp of ⅛ through 4 are described and illustrated in 12-p bulletin D-2507. Typical applications and condensed specs are given. Reliance Electric and Engineering Company

131 **Silicone potting compound** which permits visual and instrument checking of individual parts within a potted assembly is introduced in 4-p brochure 10-505. Dow Corning Corporation

132 **Vertical motors,** solid- and hollow-shaft types rated 150 hp, frames 584 and larger are featured in comprehensive 16-p bulletin 219. Variations in scope, design, applications, dimensions and enclosures are included. Ideal Electric and Manufacturing Co

HEAT EXCHANGE

133 **Fired heat exchangers** meeting temperature ratings up to 1900 F, flow rates of air up to 550 lb per sec and pressure ratings up to 5000 psig are featured in new bulletin 113. Special designs are also described. Thermal Research & Engineering Corp

134 **Heat-exchanger tubing** is discussed in 19-p catalog. Shows comparative-cost charts, conversion tables. Covers use of integral-finned tube. Calumet & Hecla, Inc, Wolverine Tube Div

135 **Tube alloys** for heat exchangers are covered in new 8-p brochure. Composition and application specs are listed. Scovill Manufacturing Company

136 **Steel tubing** for heat-transfer equipment is featured in 4-p bulletin TDC-142B. Data on mechanical and physical properties of seamless and welded carbon-steel pressure tubing is included. Babcock & Wilcox Company, Tubular Products Div

INSTRUMENTATION

137 **Electric tachometers** are featured in 4-p bulletin. Firm's new line is covered. The Electro-Mechano Company

138 **Radiation pyrometer** for measuring temperature of a hot body by its emission of radiant energy is featured in 4-p catalog 105. Principles of radiation pyrometry are explained. Pyrometer Instrument Co, Inc

139 **Electrical heat control** with infinite wattage range shuts off power when desired heat is reached—new bulletin gives details. Industrial Steam Equipment Company

140 **Control drives** for the operation and positioning of regulating devices through mechanical linkage are featured in 6-p product specification bulletin P81-1. Bailey Meter Company

141 **Sensing-transmitting instrument** that controls pressure or temperature by proportioning of process or combustion rate to load demands is announced in 12-p brochure. Operational, application and installation info, diagrams of internal wiring, dimensional and mounting data are included. Cleveland Controls, Inc

142 **Meter-relay,** continuous-reading type showing circuit level even while control circuits are energized, is topic of 4-p bulletin S-2. Assembly Products, Inc

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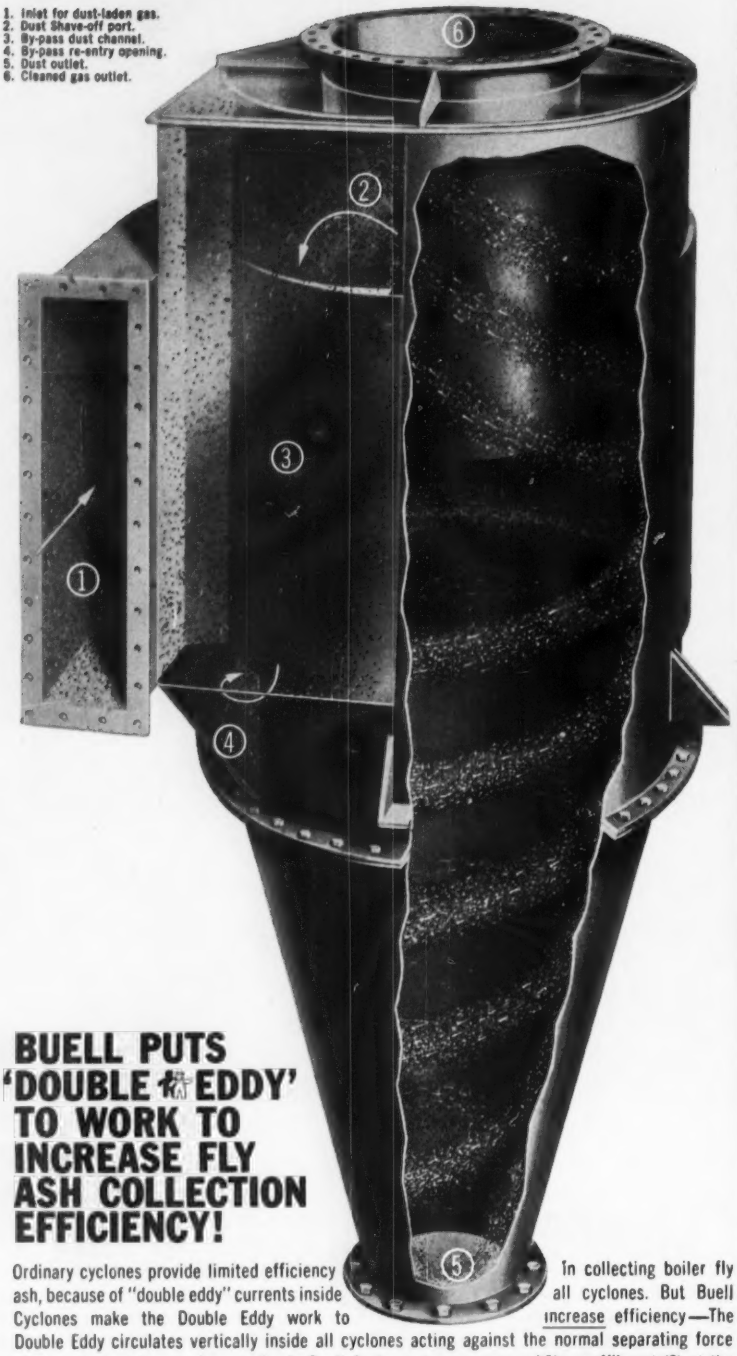
For more facts circle 257 on Reader Service card, p 101



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Free literature

Begins on page 101A

143 **Autographic plotters,** multi-channel type for saving testing time by visual data plotting, are covered in bulletin PG-100. Application data and specs are included. Gilmore Industries, Inc

144 **Performance meter,** direct-reading type for diesel, gasoline, natural-gas and steam engines, is described in data sheet. Time averaged pressure of engine cylinders can be read on meter's dial while engine is running. The Korfund Co, Inc

145 **Liquid meters** are topic of 20-p bulletin 43. Size, capacity, price, tables aid selection. Buffalo Meter Company

146 **Subminiature indicator,** showing elapsed-time operation, is described in product specification sheet 5001. Waltham Precision Instrument Company

147 **Weighing system fact folders** for collection of competitive data provide info on "rolling ball" head and instrumentation. The A H Emery Company

148 **"Guide to i-p-gas metered service"** is an illustrated booklet with tables for simplifying meter selection and installation. American Meter Company

149 **High-pressure water gage** for boilers is topic of data sheet. Gives operation, construction and rating details. Jerguson Gage & Valve Company

150 **Three - channel amplifier** for driving recording oscillographs from low-level accelerometer is described in 2-p bulletin. Columbia Research Laboratories

151 **Temperature-control valve,** back-pressure regulator valve, both pilot-operated, are subjects of new - product sheets JNP-2, JNP-3. OPW-Jordan

152 **Valve controls** are topic of 4-p bulletin 21-58. Operational information and diagrams are given. Philadelphia Gear Corp

153 **Thermocouples,** components and accessories are featured in newly-revised 52-p catalog EN-S2 which details firm's complete line. General applications, specialized applications, guide to replacement parts, accessories, instruments are some topics covered. Leeds & Northrup Co

154 **Static controls** for switching and modulating high - amp ac circuits are featured in 4-p brochure 101. Ovitron Corp

WELDING

155 **Arc-welding cable connections,** accessories are covered in 12-p

Bingham

'DOUBLE VOLUTE' BARREL TYPE BOILER FEED PUMPS

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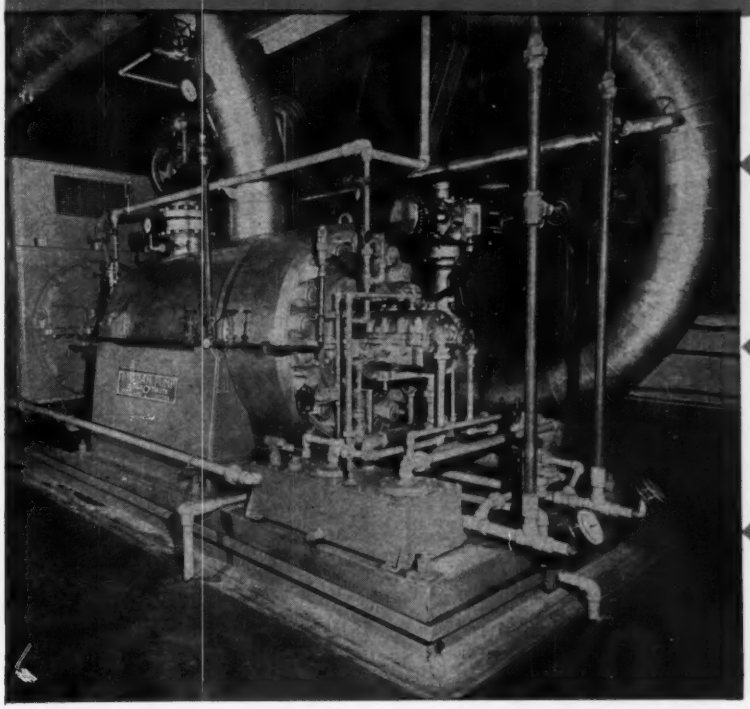

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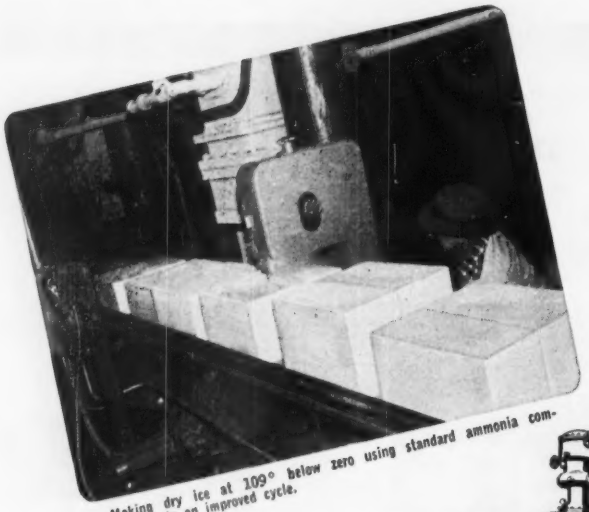

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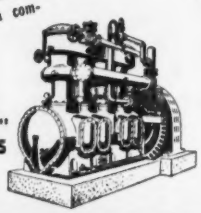

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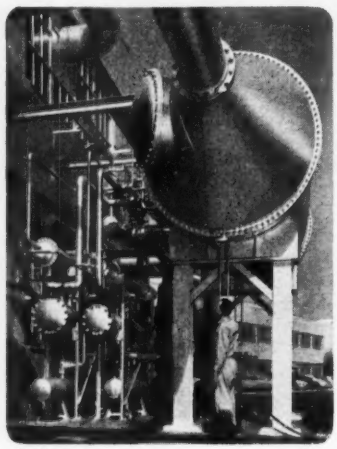

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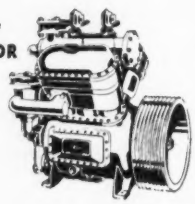

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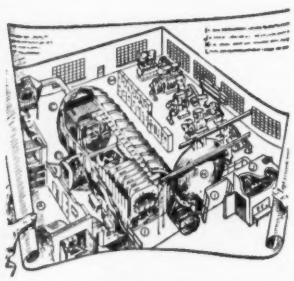

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Free literature

Begins on page 101A

bulletin 12. Firm's complete line is described. Tweco Products, Inc

156 **Pipe-weld preparation** is featured on specification sheet. E H Wachs Company

MAINTENANCE

157 **Fretting-corrosion control** and ways to control corrosion in variable-speed sheaves are discussed in new bulletin 7102. T B Wood's Sons Company

158 **Refractories,** chrome-mortar and chrome-castable type, are featured in product specification sheets 72, 73. Sheets are said to be effective guides to product selection, use, application and service. H K Porter Co, Inc

MECHANICAL POWER TRANSMISSION

159 **Gearmotors** from ¼ to 100 hp are described in 8-p bulletin 51B9172. All motor types including right - angle and special designs are covered. Allis-Chalmers Manufacturing Co

160 **Sliding journal bearings,** tilting-pad journal bearings from 2½ through 12 in. and tilting-pad thrust bearings from 4 through 45 in. are topics of three new catalogs W-1, W-2 and W-3. Waukesha Bearings Corp

161 **Speed reducers,** shaft-mounted, are described and illustrated in 24-p booklet J-19 which lists design features, and for selection procedure includes application, dimensions and recommended part sizes info in tabular form. Hewitt-Robins, Inc

162 **Speed reducers,** in - line and right-angle helical drives, are featured in 24-p booklet J-18. Rating tables, selection procedures, technical data are included. Hewitt-Robins, Inc

163 **Chain drives** are topic of product bulletin 59126. Installation, operation, maintenance procedures are given. Chain Belt Co

PUMPS

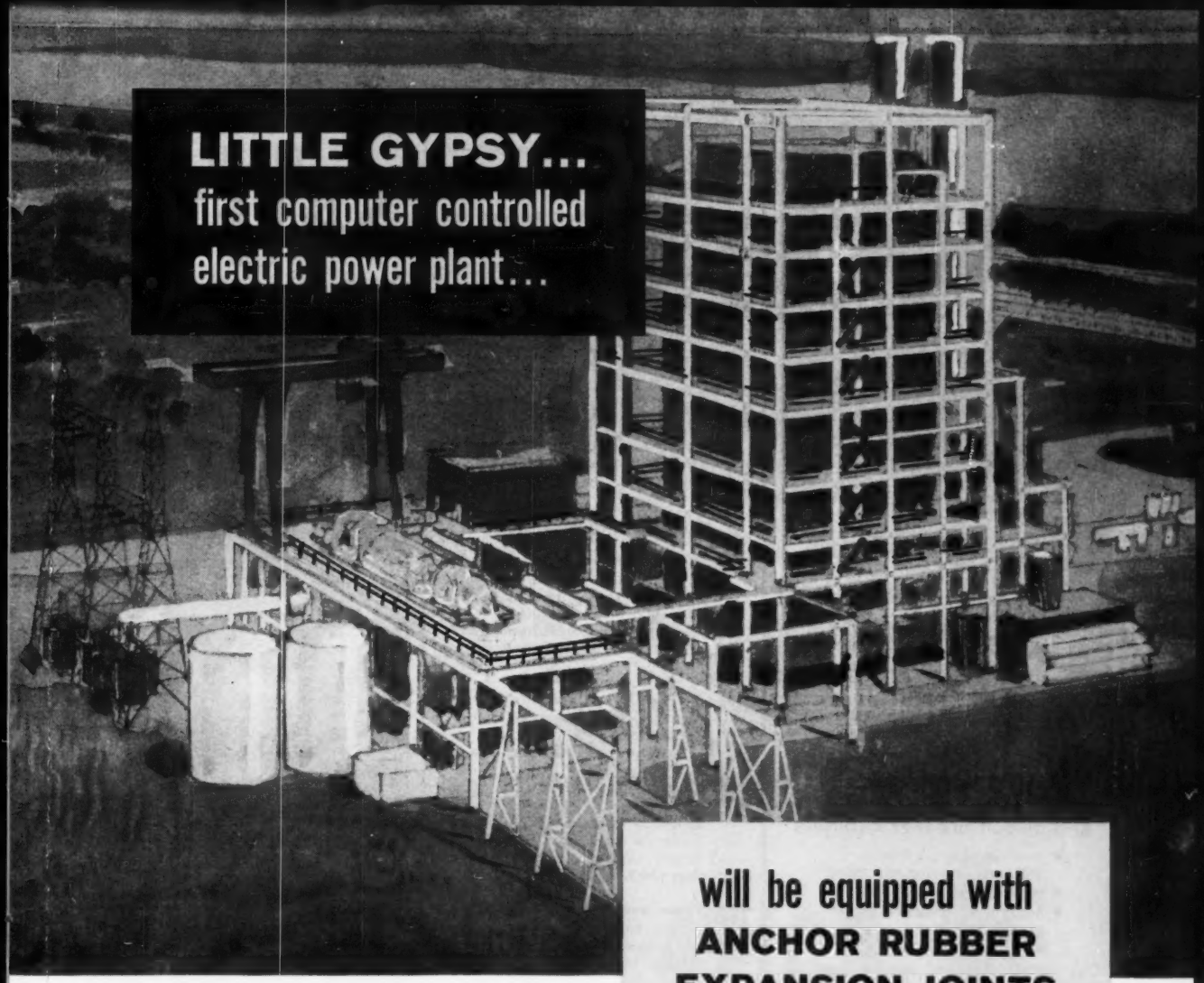
164 **Centrifugal pumps,** bronze and iron, with capacities up to 320 gpm and pressures to 40 psi are described in 6-p bulletin 1004. Marine Products Company

165 **Proportioning pump,** plunger type with small capacity for treatment of small, low-pressure boilers is featured in 2-p book 1107-20-1. B-I-F Industries, Inc

STEAM GENERATION

166 **Packaged firetube boilers** are discussed in 12-p brochure. Covers boiler standards, design trends, operation, ratings, factory tests. Cleaver-Brooks Co

continued



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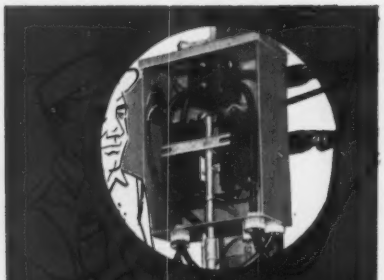

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Free literature

Begins on page 101A

167 **Continuous boiler - blowoff** systems are discussed as heat savers in bulletin 5700-A. Cochrane Corporation

168 **Packaged automatic boilers** are featured in 12-p bulletin. Firm's complete line is described, ratings, dimensions, drawings included. Orr & Sembower, Inc

169 **Packaged automatic boilers** for low-pressure steam or hot-water heating are topic of 4-p bulletin. Orr & Sembower, Inc

VALVES, PIPING, FITTINGS AND SPECIALTIES

170 **Plastic pipe** is discussed in 16-p bulletin CE-80. Tables of sizes, weights and pressures, technical data and info on plastic fittings and valves are included. Amerace Corporation, American Hard Rubber Co Div

171 **General commercial tube** selector is a 4-p folder of tube-mill products. Specs included. Scovill Manufacturing Co, Mills Div

172 **Pipeline flow control** through application of adjustable-speed units to pipeline pumping stations is topic of 8-p bulletin A-519. American - Standard, Industrial Div

173 **Traps and strainers** are featured in 4-p folder with tabular data on dimensions, weights, capacities, pressure and temperature. L-R-P, Inc

174 **Iron-body gate valves** are topic of bulletin which lists firm's new line. Service ratings, sizes and dimensions, material specifications are given. Walworth Co

175 **Motors** for slip-stem valves are featured in 8-p product specification bulletin S1-16-2. Integral strain release, stroke adjustment are some features. Minneapolis-Honeywell Regulator Co

176 **Pressure regulators,** strainers, flow control, sequence, quick exhaust valves are described and illustrated in 8-p brochure 91021. Specs, features and dimensions are given. Airmatic Valve, Inc

177 **Pressure regulator** for reducing applications and differential-operated trip valve for use on transmission lines, section valves and regulator and compressor stations to isolate line breaks are described in bulletins 124, 170. American Meter Company

178 **Bronze and iron-body gate,** globe and check valves for heating, piping and air-conditioning systems are featured in new bulletin V-6. Cayton Inc

continued

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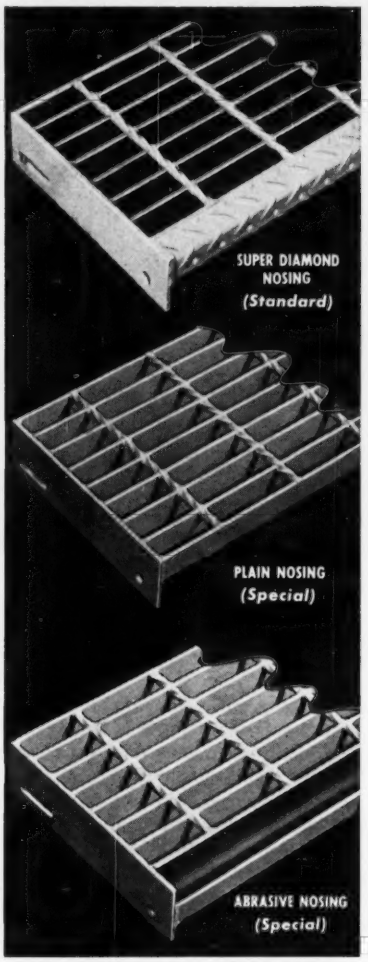

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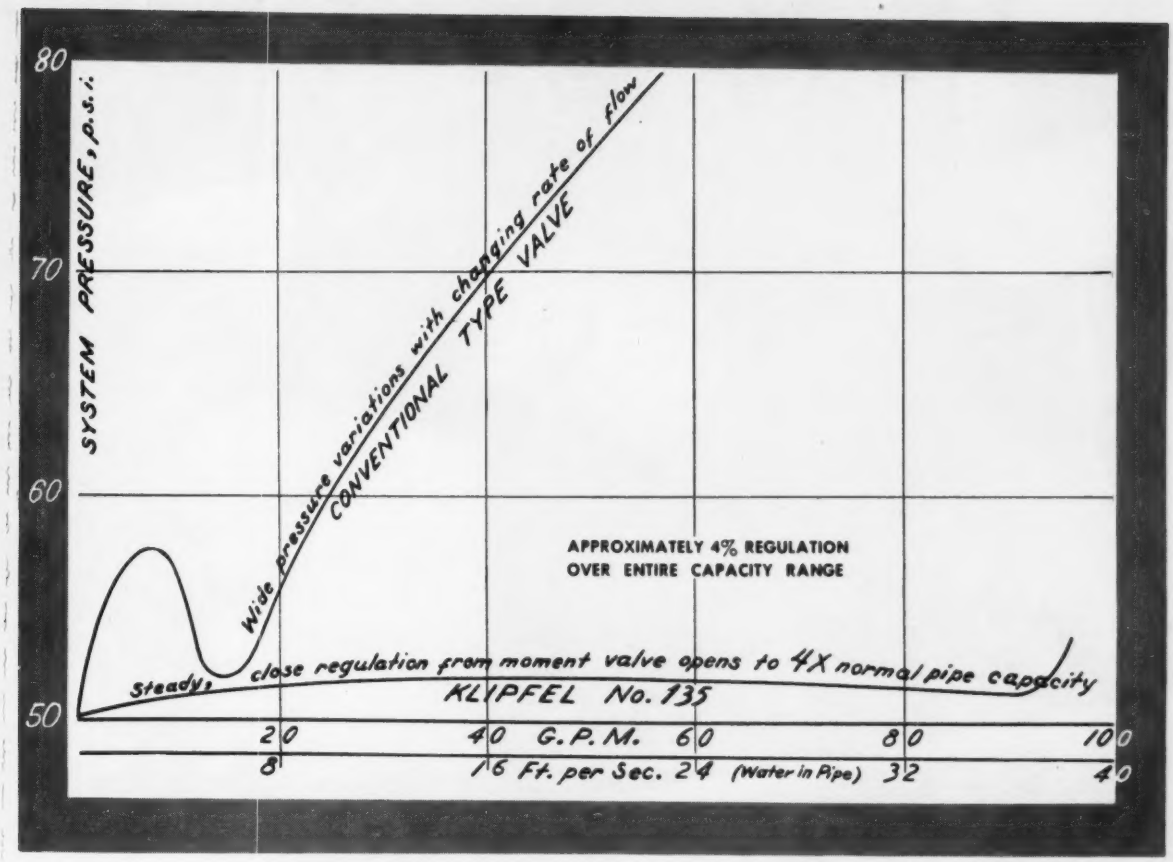

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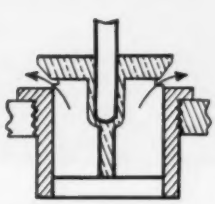
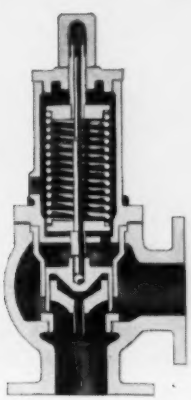


CONVENTIONAL VALVE



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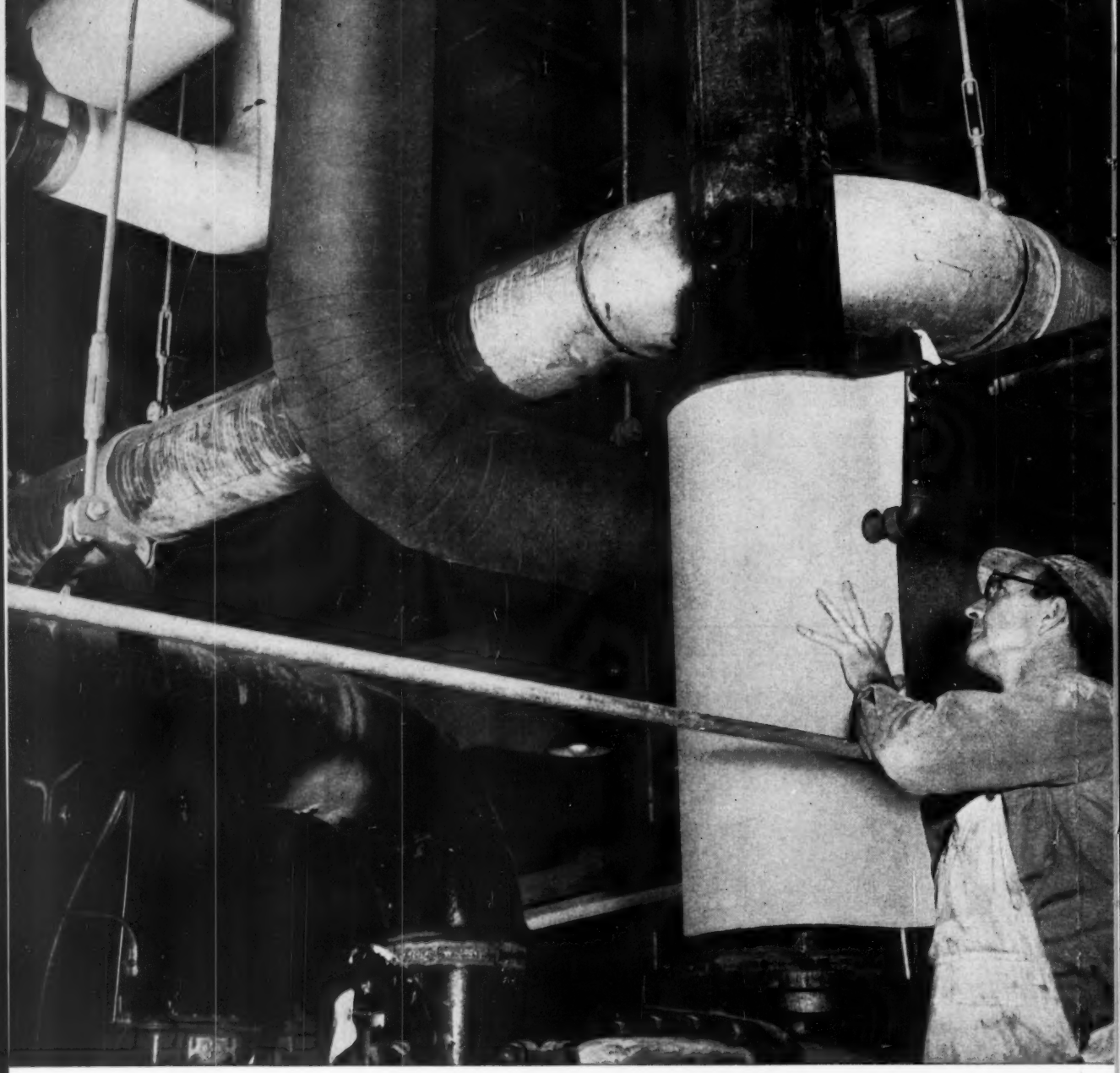

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FOR FREE TEVA SURVEY CALL YOUR LOCAL G-B SNAP*ON DISTRIBUTOR LISTED IN ADJOINING COLUMN

Compare insulations for plant piping jobs, for example — and you will agree that for economy, performance, and thermal efficiency, there is *nothing* like G-B Snap*On, the original one-piece pipe insulation molded of fine glass fibers. It's far cheaper to apply under all plant conditions—crowded quarters . . . long straight lines . . . hot or cold piping that involves numerous bends, valves, and obstructions. And G-B Snap*On is the only one-piece insulation available in a complete range of sizes from copper tubing to 36″, plain or with jackets. But see for yourself—ask your local G-B distributor to make a TEVA (Thermo-Economic Value Analysis) survey so you can compare "K" factors and cost factors as they apply to your own insulating jobs.

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Thermal and acoustical glass fiber insulations . . . molded glass fiber pipe insulation
Couplings and fittings for plain and grooved end pipe

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TALLAHASSEE, Fla., Baker's, Inc.
TAMPA, Fla., Eagle Roofing & Art Metal Works, Inc.
TULSA, Okla., Ball Distributing & Engr. Co.
TUPELO, Miss., Paine Supply Co.
WASHINGTON, D. C., Walter E. Campbell Co., Inc.
WICHITA, Kans., General Metals, Inc.

Free literature

Begins on page 101A

179 **Motorized valve operators** are topic of 20-p catalog. Philadelphia Gear Corp

180 **Seals** for regulating valves, pressure switches, remote positioners, balanced valves, etc are topics of loose-leaf manual. Applications, standard tolerances tables, installation techniques are given. Bellofram Corp

181 **Molded cups** for pump pistons, hydraulic service and pneumatic equipment are featured in new bulletin AD-145. Construction details, sizes, operation info are included. The Garlock Packing Company

182 **Bubbler** for use in gas and air lines to control and visually indicate relatively small rates of flow is described in specification sheet 3285. King Engineering Corporation

183 **Metal O-ring design** manual is 8-p folder of descriptions and illustrations of firm's line. Four specification sheets of technical data are included. The Advanced Products Co

184 **Retaining - rings** specification manual has 40 pp, contains application illustrations, info on selection of materials and finishes, design factors, charts on rotative speeds and thrust loads, typical layouts for both internal and external applications. Ramsey Corp, Retaining Ring Div

185 **Mechanical-packings** catalog has 64 pp of comprehensive information on firm's complete line. Wide selection of cross-section photos, simplified packing chart aids selection. Johns-Manville Co

186 **Expansion joints** are discussed in 6-p bulletin. Info is on nomenclature and selection of firm's line. Badger Manufacturing Company

187 **Swing joints** in bronze, steel, monel and aluminum are subject of 12-p bulletin F-8. Specifications are given. OPW-Jordan

188 **Hinged closures** which one man can handle have built-in safety features for vacuum, low- and high-pressure service. Described in 4-p bulletin. Chemetron Corporation, Tube Turns Div

WATER TREATMENT

189 **Mixed - bed demineralizer** problems are covered in reprint 121. Experience at a public-utility plant in the East is described. Cochrane Corporation

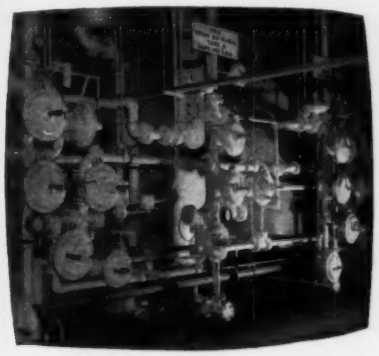
190 **Water problems** in air - conditioning systems are the topic of bulletin 596. Covers corrosion,

continued

THESE NEW IDEAS HAVE COME FROM

ILLCO-WAY DESIGNERS AND BUILDERS

MODERN EQUIPMENT FOR ionXchange



Illinois Water Treatment Co. was incorporated over 20 years ago to use the newly-discovered resins in the development of ionXchangers.

1942 By this time, IWT had already built more than 50 successful multi-bed ionXchangers (some of which are still in use today).

1943 IWT brought "automation" to ionXchange with the introduction of automatic ionXchangers, some of which were very large. (Some of *these* are still operating today, also.)

1947 This was the year when IWT brought out the first large (400 gpm) ionXchanger for silica removal.

1949 IWT built the first commercial *Mixed Bed* ionXchanger.
(U.S. Patents 2605084 2771424)

1954 A huge 5,000 gpm fully-automatic mixed-bed ionXchanger was designed and built by IWT to remove silica from make-up water for high-pressure boilers. This plant has now de-ionized over SIXTY BILLION pounds of water.

1957 IWT introduced "Counterflow," the first really new idea in multi-bed ionXchangers since the introduction of silica-removal techniques. (Patent pending.)

THIS EXPERIENCE CAN MEAN A LOT TO YOU

These ideas, and other IWT developments, can mean reduced costs, improved operations, and greater efficiency in your plant. *Check with your IWT representative.*

ILLINOIS WATER TREATMENT CO.
840 CEDAR ST., ROCKFORD, ILLINOIS
NEW YORK OFFICE: 141 E. 44th St., New York 17, N.Y.
CANADIAN DIST.: Pumps & Softeners, Ltd., London, Ont.

The design work on all these new substations is going to be hard to handle with our present force.

Of course! They have enough to do handling routine duties. Why don't you call in PIONEER?

GIVE YOUR NON-ROUTINE OPERATIONS TO PIONEER

Design and Consulting Engineering Services

Pioneer has specialized in designing power plants for 57 years. It offers design service for fossil fuel, hydro and atomic plants. It will also assist in forecasting load growth, in site selection, in purchasing and expediting of equipment and in supervising construction. Pioneer's other services include substation, transmission and distribution studies and design.

Services in Regulatory Matters

Pioneer offers its services in all phases of Federal, State and Local regulation including the rate base, depreciation analysis, cost of service studies, market analysis, certificate proceedings and rate of return.

Corporate Services

Pioneer's services in corporate matters include business and management engineering advice, financial, accounting and tax counsel and insurance and pension plans and programming. It maintains a complete stock transfer, ledger and dividend disbursement service.

NEW!
On your letterhead, write for 40-page booklet, "Pioneering New Horizons in Power". Describes, illustrates Pioneer's engineering services, and corporate services, from financing to operation.

57 YEARS

Pioneer Service & Engineering Co.

231 South La Salle Street
Chicago 4, Illinois

Free literature

Begins on page 101A

scale formation, slime and algae growths in 4 pp. Betz Laboratories, Inc

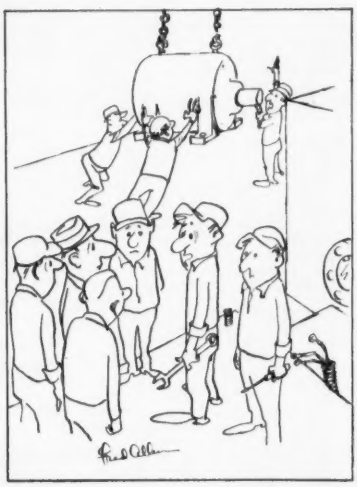
191 **Glucosate** as a control for scale and corrosion problems is topic of new bulletin. Glucosate is available in several compositions to match specific needs. D W Hearing & Company, Inc

---

First "man" on moon may be a robot — remote-control "Mobot" developed by Hughes Aircraft Co can be applied to most situations too dangerous for man to undertake by himself. Example: Crablike Mobots could swim underwater, plant and harvest seaweed to feed world's future populations.

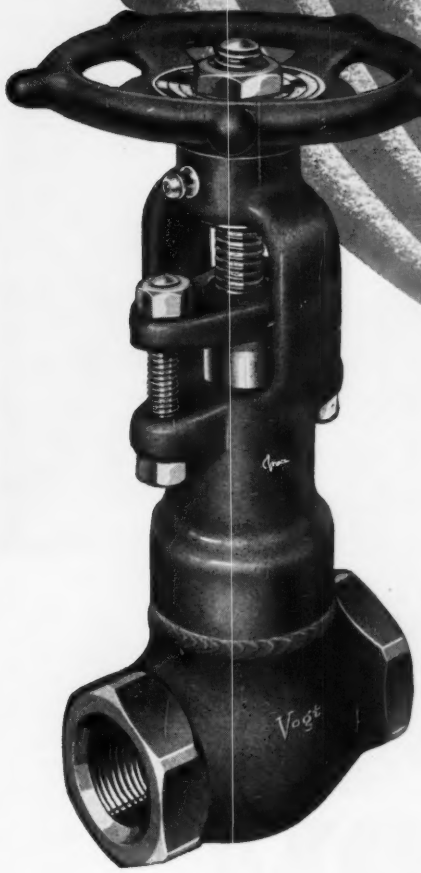
Tubular quartz infrared lamps develop temperatures from 150 to 1600 F, states General Electric Company. They're used where high heat concentration is needed, space is at a premium, thermal shock is likely, fast heating rates and accurate temperature control are necessary.

Britain's Central Electricity Generating Board plans a 1-million-kw nuclear-power station on River Severn in southwest England.



"No, I didn't check the fuses . . . didn't any of you guys?"

Another addition to the Vogt line of TOP QUALITY valves . . .



Forged Steel
WELDED BONNET

GENERAL GP PURPOSE

Gate and Globe
VALVES

150-800 Pounds Service

To eliminate forever potential body-bonnet leaks, Vogt engineers have developed these new General Purpose valves with seal welded bonnet joints.

This new addition to the world's most complete line of forged steel valves incorporates all the features of other Vogt GP valves—hard faced seats, hardened stainless steel wedges, drop forged pressure parts, and the numerous other advantages of Vogt's valve line.

The desirable safety feature of a back seat on the stem is retained while still offering the elimination of a possible body-bonnet leak.

Available NOW in both gate and globe types, ¼" thru 2", and in both socket weld and screw ends. These are priced identical to the bolted bonnet GP valves; gate valves the same as Series 12111 and globe valves the same as Series 12141.

Address Dept. 24A-FP for literature

Series 2801 Gate Valve
Illustrated

Series 2821 Globe Valve
Also Available

Both series identical in dimensions and have 13% chrome stainless steel trim.

Vogt

GENERAL GP PURPOSE — Vogt FOR BETTER VALVES

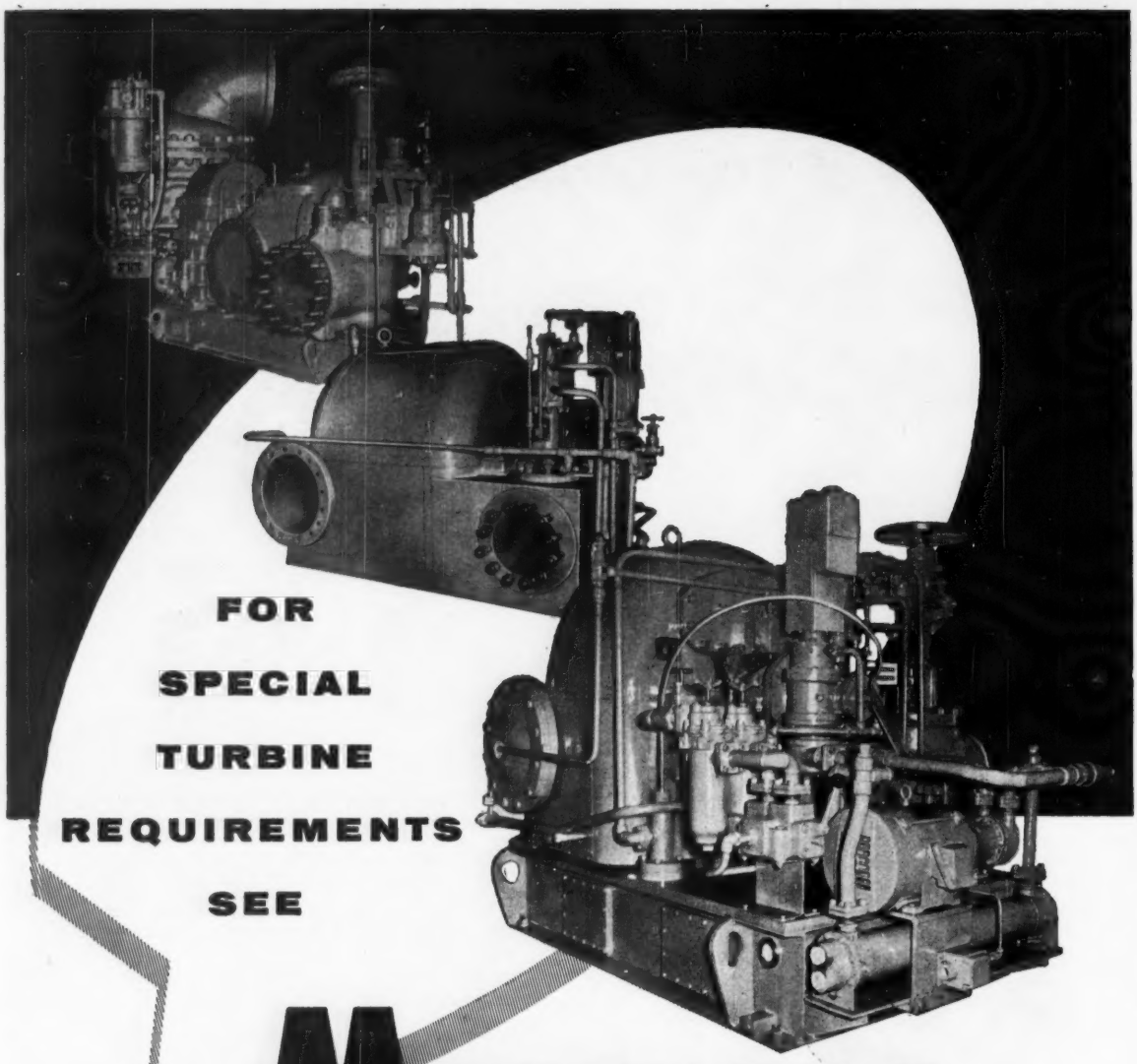
HENRY VOGT MACHINE COMPANY, Louisville, Ky.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Camden, N. J., St. Louis, Charleston, W. Va., Cincinnati.

FORGED STEEL

VALVES

For more facts circle 268 on Reader Service card, p 101



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Murray TURBINES

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- High Speeds
- Variable Speed Ranges
- Precise Control
- Multi-Valve Designs
- Double End Gear Drives
- Vertical Shaft Turbines

Our nearest representative will help you solve your turbine requirements. His name gladly sent on request.

MURRAY IRON WORKS COMPANY • BURLINGTON, IOWA

Builders of Steam Power Equipment for Nearly a Century

Hall Industrial Water Report

VOLUME 7 NOVEMBER 1959 NUMBER 6

How Will It Come Out?

Industrial water softeners of many types are daily turning out millions of gallons of treated boiler feedwater. Usually the softener effluents are of good quality, meeting chemical specifications and suitable for the intended use. But things can go wrong both mechanically and chemically, and close control is essential to make sure the water "will come out all right."

Hall Laboratories engineers are thoroughly familiar with water softening procedures and equipment. They can serve you not only in setting up, but also in maintaining the routine control necessary to make your equipment operate efficiently. And they can help you determine the cause of trouble when, for no obvious reason, effluent quality is poor.

Coagulant Aid Helps Softening

The hot lime soda—hot zeolite water softener at a western paper mill functioned satisfactorily until demand pushed flow rate up to and beyond the capacity of the unit. Then more sludge was carried out of the sedimentation tank in the lime soda-treated water than the filters could handle. Some went on to the hot zeolite softeners, seriously fouling the ion exchange material. Excessive backwashing was necessary.

Hall engineer L. Arnold considered how he might hasten settling of precipitated sludge in the sedimentation tank. He recommended the use of a Hagan coagulant aid because this represented the quickest and probably most effective move.

Results were impressive. Soon after the aid was added to the lime and soda ash chemical tank the settled water cleared up. The plant operators enthusiastically pointed out that there was less suspended material in the water going to the filters than there had been previously in the effluent coming out of them.

Hardening Condensate

An automobile parts manufacturing plant prepares boiler feedwater in a hot-process softener. There are two sections in the equipment, one for deaeration of condensate and one for heating and lime-soda softening of makeup. The softened water is filtered and combined with the deaerated condensate.

The operators watched water conditions carefully and operated without trouble for some time. Then one day they were puzzled by unprecedented difficulty in maintaining reserve phosphate in the boiler water. Wishing to solve the problem as quickly as possible they called Hall engineer D. W. Whiteside.

When Whiteside arrived at the plant the operators reported to him their observation that the normally clear boiler feedwater was turbid. The turbidity was quickly determined to be sludge from the softening section of the hot process unit. Further checking showed that the sludge was in the deaerated condensate while the treated, filtered makeup water was clear.

Now it was obvious that something was wrong inside the softener, permitting treated water from the softening section to get into the condensate section. Subsequent inspection revealed partial plugging of the downflow pipe through which treated water flowed from the primary softening zone to the settling chamber. Water level rose high enough in the primary softening zone to spill the treated water over the baffle separating this from the condensate section.

A good cleaning of the downflow pipe corrected the trouble. Routine cleaning during regularly scheduled shutdowns was established to avoid future difficulty.

Care of Ion Exchange Resins

Exchange resins are expensive. A running check on performance is important in setting up cleaning and replacement programs which assure maximum useful life and put replacement cost on a uniform annual basis thus avoiding sudden major replacement expenditures.

Plant operators should carefully watch the relationship between raw water composition and gallons of water treated between regenerations of cation exchangers. A noticeable drop in capacity can give early warning of the need for cleaning.

Gradual increase in pressure drop across a cation bed is an indication that the material is becoming dirty or is starting to break down. This information should be used in conjunction with service capacity data to check condition of the resin.

Crosslinkage checks are desirable about once per year for small cation units and twice per year for large units. If caught in time, breakdown can sometimes be retarded by treatment of the water with sodium sulfite or sulfur dioxide.

The condition of anion exchange material is best watched by observing the amount of dissolved solids removed per cubic foot of resin per cycle.

Rinse requirement is important too. Increase often means deterioration or fouling. The observations may be used alone or together to determine the need for cleaning or replacement.

Hall engineers can help you set up and maintain routine testing and regeneration programs as well as the longer term checks on performance. Furthermore, Hall Laboratories is well equipped and staffed to do special work on resin capacity, crosslinkage and experimental cleaning.

Water is your industry's most important raw material. Use it wisely.

Industrial Water Problems Require Special Handling

There are no "stock answers" to industrial water problems. For information on how the Hall System can help you solve your particular water problems, write, wire or call address below.

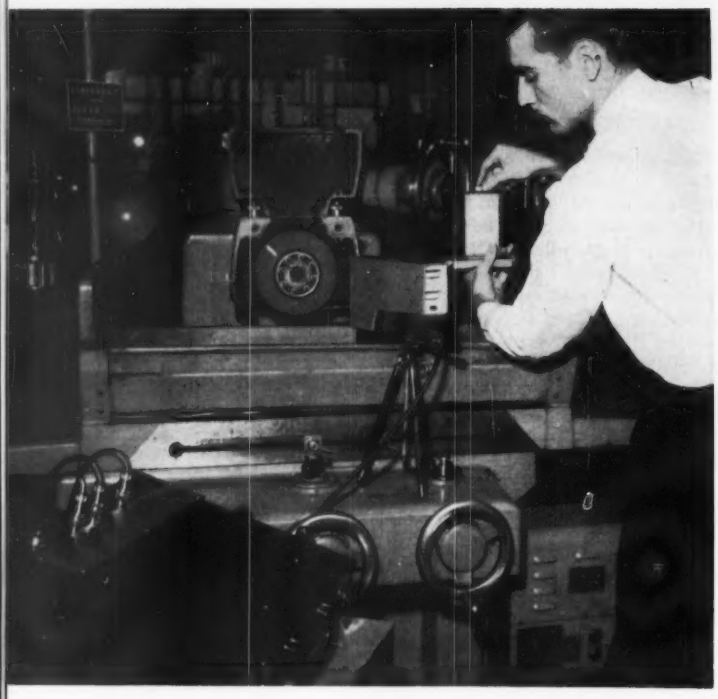
HALL LABORATORIES
DIVISION OF HAGAN CHEMICALS & CONTROLS, INC.
HAGAN BUILDING, PITTSBURGH 30, PA.
In Canada: Hagan Corporation (Canada) Limited, Toronto

Hall Laboratories—Consultants on Procurement, Treatment, Use and Disposal of Industrial Water

Equipment design of the month

By STEVE ELONKA
Associate Editor

On this page each month you'll see the wraps taken off a significant new product, material or process for the first time in the power field



Portable in-place balancer sets trend for tomorrow's equipment

In the near future you'll see many developments in dynamic balancers to keep your rotating equipment running as nearly vibration free as possible (see *Balancing Rotating Equipment*, POWER, June 1959.) This portable unit was developed by the Stewart-Warner Corp of Chicago. It consists of a strobe and meter head, electronic unit, vibration pickup, tripod and carrying case. Balancer operates on 115-v 60-cycle single-phase current.

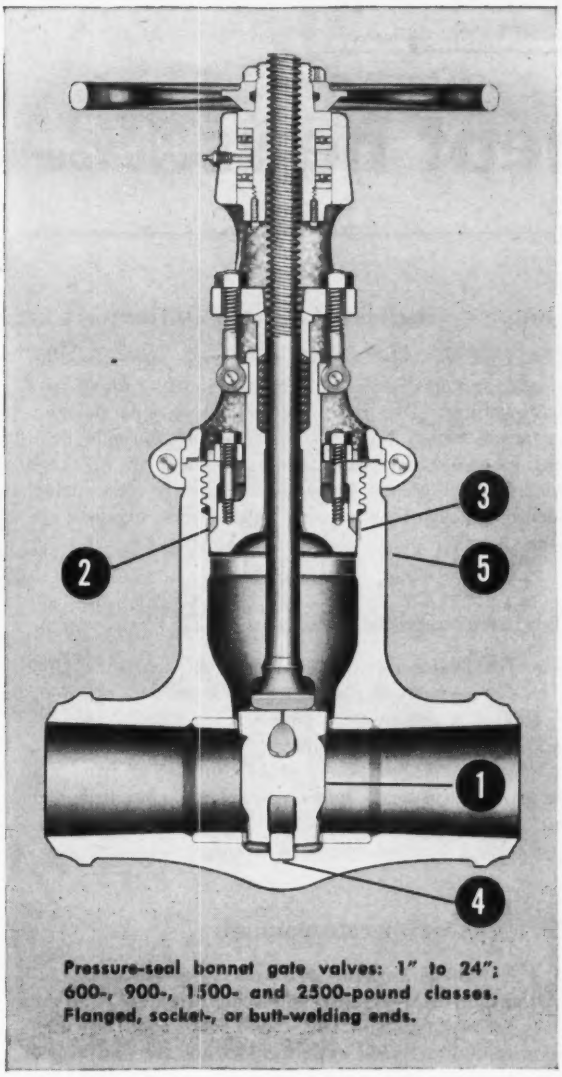
Stroboscope and meter indicate angle of unbalance and amount of vibration. For 1-man operation, you can read meter and strobe together—they're mounted in the same portable head. And head can be set in any location so operator has a hand free for other work.

Electronic unit amplifies electrical impulses from pickup and triggers strobe light. Unit is equipped with extra outlet for connection of second pickup—when balancing extra-long work you can take all readings of angle and amount of unbalance without changing position.

Vibration pickup electromagnetically converts amplitude of vibration of part being tested into electrical impulses. Versatile design permits base mounting, or there's a hand-held detachable probe for hard-to-reach places. Resonance type pickup automatically filters out extraneous vibrations, registers only machine being tested.

Balancer first determines rpm and amount of vibration. Then it pinpoints the trouble source by freezing image of rotating part with the stroboscopic light. Sensitivity is adjustable from below ten-millionths of an inch to over 1/10-in. amplitude of vibration. This balancer will tackle trouble shooting, inspection and in-place balancing of blowers, fans, pumps, turbines, motors, engines, drive shafts, gears, couplings and grinding wheels.

For additional information circle No. 83 on Reader Service card, page 101



Pressure-seal bonnet gate valves: 1" to 24"; 600-, 900-, 1500- and 2500-pound classes. Flanged, socket-, or butt-welding ends.

Note these Features

❶ Flexible wedge disc prevents sticking.

❷ One-piece, silver-plated seal ring remains freeze-free for easy dismantling.

❸ Wear-resisting stainless steel inlay prevents corrosion at this critical point.

❹ Full-length disc guides prevent wear and drag on seating surface.

❺ Design saves up to 60% of weight of bolted bonnet valves.

ALL CRANE PRESSURE-SEAL BONNET VALVES ARE ASA-RATED

Minimum metal thicknesses comply fully with the requirements of ASA B16.5-1957 as well as ASA Code for Pressure Piping and ASME Boiler and Pressure Vessel Code.

New globe lift-checks. Feature only two internal parts: cage-type disc and liner. 900-pound class, 3" to 12"; 1500-pound class, 2½" to 12"; butt-welding ends. Stop-checks available also.

Globe and angle valves. Globe valves of Y-pattern design in all sizes; interior areas shaped to decrease turbulence, reduce pressure drop. 1" to 16"; 1500-pound class; socket- and butt-welding ends.

Modern controls for steam stations...
Crane pressure-seal bonnet gate valves

Here is the most modern valve designed for high-pressure/high-temperature service. Bonnet joint leakage is eliminated. Weight is reduced without sacrificing strength and safety. Its streamlined contour simplifies insulation. Easy accessibility provides for quick, in-line servicing. Critical points of wear are protected by special metals. These and other advantages assure trouble-free service with minimum maintenance.

For complete facts about this gate valve and all other valves in the *expanded and improved line* of Crane valves for power plant service, see your Crane Representative.

CRANE® VALVES & FITTINGS

PIPE • PLUMBING • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Illinois—Branches and Wholesalers Serving All Areas

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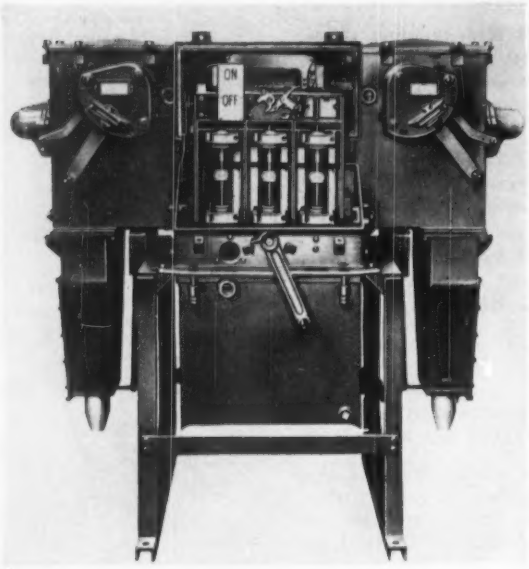
For more facts circle 271 on Reader Service card, p 101

For more data on these developments, circle key numbers on Reader Service card, p 101

Plant equipment news... Your



Compact circuit breaker rated 200 amp

2 • Unit provides effective dielectric separation of breaker contacts because of companion-trip feature, says manufacturer. Two poles are located in separate compartments within breaker's case, linked externally by a single handle. Hydraulic timing element in breaker's solenoid coil creates a controlled inverse time delay. Kick-spring provides tripping action when overload occurs on either pole.—Heinemann Electric Co

Engine generator weighs just 123 lb

3 • The 4-cycle aluminum engine is the heart of a portable, compact power plant rated 2500 w, developing up to 3000-w ac intermittent power. Unit weighs only 123 lb including carrying handle.

You can get full power at 115 or 230 v from one outlet, manufacturer states. Regularly equipped with carrying handle, model is also available with stationary base or 2-wheel dolly.—Wincharger Corporation

Load-break switch avoids single-phasing

1 • Current-limiting fuses used in this 15-kv 3-phase outdoor switch are equipped with striker pins. When a fuse in any one phase blows, striker pin trips switch, prevents single-phasing protected equipment. Unit has a basic insulation level of 150 kv, can be used for operating voltages between 2.4 and 13.8 kv. Fuse switch has interrupting capacity of 250 mva at 13.8 kv. Various terminals are available.—Electro Machinery Corp

L-v breakers operate manually

4 • Manually-operated stored-energy mechanisms are available in firm's l-v power circuit breakers, in frame sizes Ak-2-50, 75, and 100, rated 1600, 3000 and 4000 amp, to 600 v. Spring-close mechanisms are said to provide positive, constant, high-speed closing of contacts for greater safety and longer contact life. Unit has self-aligning mechanism to reduce wear, and individually spring-loaded contacts.—General Electric Co

Work aisle protects switchgear

5 • Protective work aisle for 5 and 15 kv metalclad switchgear provides safe conditions for inspection and maintenance in all kinds of weather, according to manufacturer. Work aisle can be mounted directly on piers—no concrete pads are needed when you install it.

Extensive work area is large enough for two breakers to pass in case they have to be interchanged. Constructed of steel with labyrinth seals and neoprene gaskets, unit is said to be sturdy, completely weatherproof.—Federal Pacific Electric Co

Power unit senses light failure

6 • Emergency lighting system will handle four 25-w sealed-beam floodlights. Sensing device turns lights on without attention whenever power supply fails, says maker. When power returns, unit automatically shuts off and begins recharging.

Self-contained unit can be mounted on wall, suspended from ceiling or placed upon floor. Weight is 60 lb for entire model including battery, charging circuit and selenium rectifier. Insulation is provided by rubber separators and sealed glass-mat retainers.—York Lighting, Inc

Cable is rubber-insulated

7 • This 28-kv power cable has 33/64-in. thick butyl-rubber insulation. Neoprene outer jacket, 7/64-in. thick, brings ID to 2.3-in.

Cable should find use as primary leads for generators, transformers and other distribution equipment in generating stations and distribution substations.

It has tested at 120-kv ac for five minutes and 150-kv dc for fifteen without evident physical or electrical deterioration, according to the manufacturer.—H K Porter Co, Inc, National Electric Div

information center for new products and materials

Pulleys team up to increase variable-speed flexibility

8 • Dual variable-pitch pulleys are used on drives in ⅛ to 2 hp range, with ratios to 4:1. *A* or *B* belts connect a combination of one spring-loaded and one manually-actuated pulley. Turning a wheel widens or narrows belt-seating groove of manually-operated pulley to control operation of drive. This produces instant inverse change in pitch diameter of spring-loaded pulley. Sizes are 3½-, 4-, 5- and 6-in. O.D.—Maurey Manufacturing Corporation

Motion-control sheave holds constant driven speed

9 • Variable-speed sheave is designed to hold a constant driven speed during changing torque loads. Sidewall pressure on belt varies in proportion to the torque required to carry the load, so pitch diameter is maintained and driven speed is kept constant regardless of torque condition. Two sizes cover 7½ to 15 and 15 to 20 hp. This sheave boasts a special lubrication system to eliminate fretting corrosion and freezing, says maker.—T B Wood's Sons Co

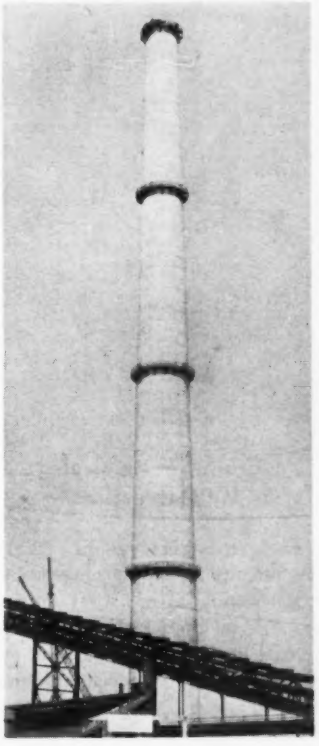
Drive-reversing coal conveyor is self-clearing

10 • Self-clearing coal conveyor has 2-way switch-controlled motor drive which makes it possible to eject obstructions simply by reversing coal-screw rotation. Coal screws and housings are made in matched sections and can be assembled to operate at any angle, with single or dual discharge chutes. Units for horizontal, cross-feed, tandem or vertical operation are available. Standard capacity is 2500 lb per hour based on 48-lb coal.—Clark & Bobertz, Inc

Mechanical-drive center-line mounted steam turbine fills requirements up to 1000 horsepower

11 • Center-line mounted steam turbine is available with a variety of frames and wheel diameters. Unit fills requirements to 1000 hp and has steam inlet pressures to 875 psig. Single-stage model is also adaptable to natural-gas expansion and to other gases such as Freon.

Vertical shaft movement is minimized because shaft mounts at points in same horizontal plane as center line. Thermal expansion occurs from the center line, reportedly cutting problems of radical misalignment between turbine and driven machine (usually caused by unequal expansion of metal in the two machines).—Dean Hill Pump Company

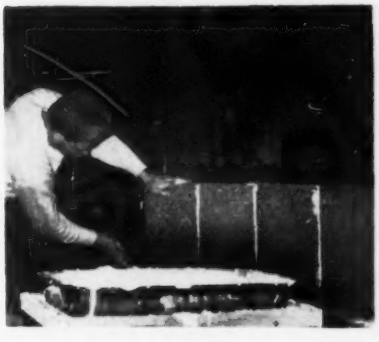


NEW 500-FT STACK will serve two boilers at Con Ed's Arthur Kill Station

Foamsil guards concrete stack in major application

12 • *Foamsil*, a foamed-silica material that bowed in last fall (see POWER, Sept 1958, p 138) finds first major application in Consolidated Edison's Arthur Kill Station on Staten Island, New York. Here acid-resistant *Foamsil* lines a 500-ft concrete chimney, protecting it from deterioration caused by h-t gases.

Inside of chimney was coated with acid-resistant bituminous compound. Then 2x11x17-in. blocks of the 99%-pure silica-glass insulation were applied. One course of acid-resistant brick for abrasion protection completed the construction. *Foamsil* can cycle from −450 to +1600 F without thermal shock, promising long life for the protected chimney.—Pittsburgh Corning Corp

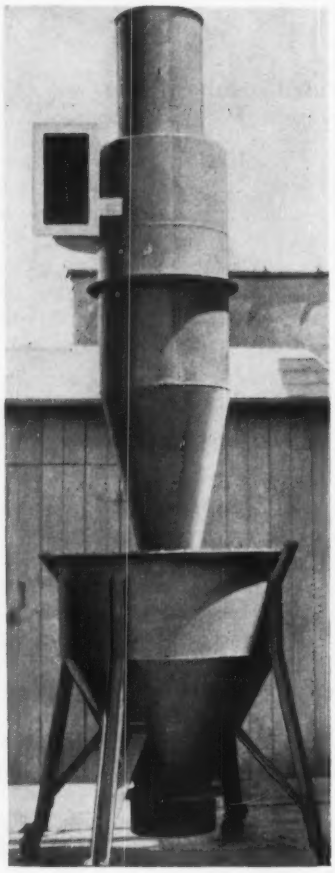


BLOCKS of *Foamsil* material are applied to stack wall against bituminous coating

For more data on these developments, circle key numbers on Reader Service card, p 101

More **equipment news**

For more data on these developments, circle key numbers on Reader Service card, p 101



Mechanical dust collector features involute design

13 • Designed for efficient collection of abrasive or heavy dust loadings, involute type collector can be arranged to handle almost any size job. Unit collects catalyst dust suspended in reactor effluent and regenerator flue gases from fluid catalytic-cracking processes. Hooked up to 24-in. steel-mesh-liner collector and electrostatic precipitator, it removes even very fine residual catalyst particles. Steel-mesh liners incorporated with castable cements are available for collection of highly abrasive dusts. Hopper discharge valve is available in a variety of sizes, single and double.—Research-Cottrell, Inc

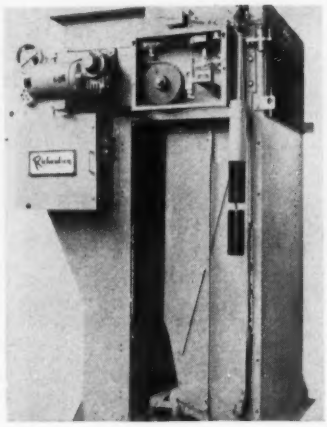
Vibrator resists water, dust

14 • Electric vibrator with water- and dust-tight construction is especially applicable to outdoor bins. According to manufacturer, unit moves stubborn materials from hoppers to conveyor belt in an accurately measured stream in any weather.

Model is totally enclosed with built-in ac motor. It uses rotating eccentric-shaft principle to develop vibration, has no pulleys or belts. Working frequency is 60 cps.—Cleveland Vibrator Company

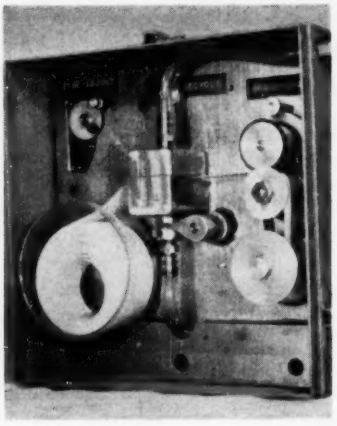
Switches control bin level

15 • Pendant float operates a sensitive switch to regulate level of material in bins. Rising level of material tilts float ball. Switch then shuts off current and stops feed-conveyor, elevator or pump. Float returns to vertical position when level falls, switch closes and feed is resumed. Control prevents choking and damage to conveyors and elevators. Normal, heavy-duty and explosionproof styles suit various needs.—Stephens-Adamson Manufacturing Company



Automatic coal scale has 1000-lb capacity

16 • Eight access doors permit quick removal of weigh hopper and easy inspection of any part of this scale. Special linings and mountings keep coal dust *in* when you open the door. When weigh hopper is loaded almost to preset weight, it comes toward balance, actuating switches, contactors and a solenoid to stop belt feeder and discharge coal from hopper. Operating levers, linkages and electrical connections are outside and protected by covers. Rugged unit boasts hourly capacity of 60 tons.—Richardson Scale Company



Paper tape samples air for dust, gas

17 • Portable air sampler records dust or gas concentrations by sucking air through a paper tape. Treated papers that change colors in presence of gases are used for gas measurements, a densitometer measures dust and a Geiger counter tests for radioactive dust. Unit collects up to 900 samples at 1.5 to 36 cu ft of air per sample, according to manufacturer. It weighs 21 lb.

Industrial hygiene, air pollution, nuclear measurements are applications suggested by maker.—Gelman Instrument Company

For more data on these developments, circle key numbers on Reader Service card, p 101

NOW...selenium rectifiers with an unlimited life span!

RADIO RECEPTOR

ANOTHER ACHIEVEMENT OF GENERAL INSTRUMENT CORPORATION

Tri-Amp

the only selenium rectifier with

NO ARTIFICIAL BARRIER LAYER

plus / superior overload characteristics • higher current ratings • lower forward voltage drop • no sudden failures • no special protective devices required • smaller size • operate in parallel or in series without special precautions

Tri-Amp is a new and completely different concept in selenium. No artificial barrier layer of any kind is used, thus eliminating the cause of aging and high voltage drop. Result is the finest rectifier ever made.

Rectification in the Radio Receptor Tri-Amp is accomplished through a P-N junction formed by a closely controlled diffusion process involving the use of cadmium-selenide and tellurium. We'll be glad to send you more complete information on this important development. Write today to Section P-1.

REALLY RR RELIABLE AUTOMATIC MANUFACTURING

GI

RADIO RECEPTOR COMPANY, INC.

Subsidiary of General Instrument Corporation

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GENERAL INSTRUMENT CORPORATION INCLUDES F. W. SICKLES DIVISION, AUTOMATIC MANUFACTURING DIVISION, RADIO RECEPTOR CO., INC., MICAMOLD ELECTRONICS MANUFACTURING CORPORATION AND HARRIS TRANSDUCER CORPORATION (SUBSIDIARIES)

For more facts circle 272 on Reader Service card, p 101

FILL IN AND MAIL TO
WESTERN CHEMICAL COMPANY
Kansas City 5, Mo.
Pioneers in the chemical control of problems relating to the use of water, steam and fuel

"I have a problem..."

- ☐ scale, corrosion, or foaming in my boiler operation
- ☐ rust and corrosion in my steam and condensate return lines
- ☐ scale, corrosion, or algae growth in my cooling or condenser water system
- ☐ corrosion or scale in my potable or plant water supply lines and tanks
- ☐ rust and corrosion in my brine or sweet water system
- ☐ scaled up pumps, water jackets, compressors, coils, lines, or equipment
- ☐ sludge and moisture in my fuel oil supply
- ☐ soot deposits in my furnace combustion areas

"I'd like to know..."

. . . exactly what specific treatment your Technical Services Dept. recommends. I understand that such problems have been your specialty for over 65 years and that you have an outstanding record for restoring and maintaining efficiency of plant equipment through advanced chemical treatment. Will look forward to receiving in the near future both your latest technical literature *and* a personal letter concerning my problem. I understand that my inquiry involves no obligation.

NAME_____ TITLE_____

FIRM_____

ADDRESS_____

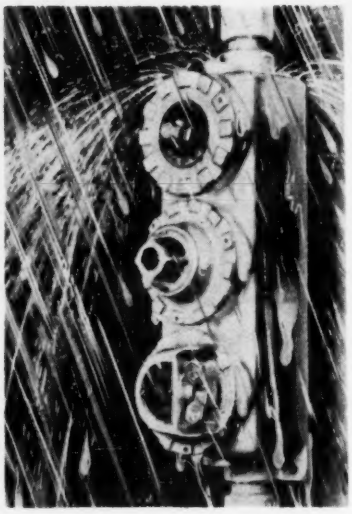
CITY_____

ZONE_____ STATE_____

Mail to Technical Services Dept., WESTERN CHEMICAL CO.
713 Washington St., Kansas City 5, Mo.

Equipment news

Begins on page 116



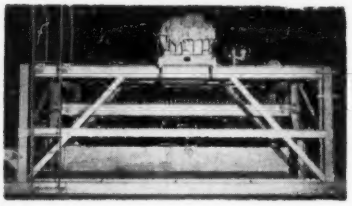
Control-station condulets

19 • Units are designed specifically for hazardous areas, indoors and outdoors. Safety seals stand up under driving rain and hose washings, says maker.—Crouse-Hinds Co

Static relay

25 • This relay eliminates confusion in relay coordination, says maker. Units can be adjusted to change slope of time-current curve (inversion index) or time to trip (time index) for coordinating given circuit.—Allis-Chalmers Mfg Co

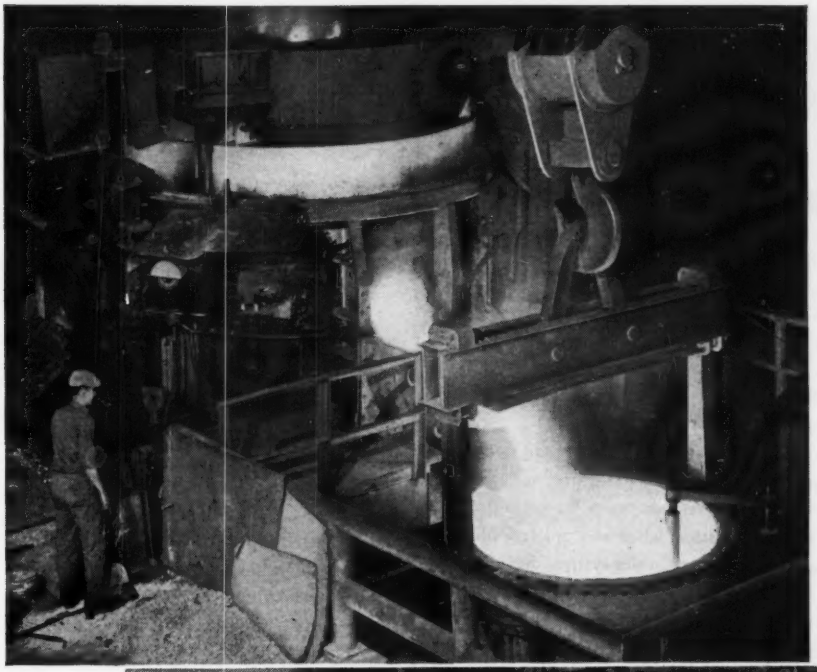
Just circle key numbers on the Reader Service card, page 101, to get complete product story



Mechanical trash rake

21 • Unit is designed specifically for cleaning debris from racks or screens in front of gates where water is required in large volume as in pumping, processing, and sewage disposal. It guides, clears, dumps from remote control or differential water level.—Frank W Stuker & Associates

continued



Tapping a 50-ton arc furnace at B&W Barberton works.

Rigid quality control is maintained through all phases of production down to final inspection.

Why B&W Hollow Forged Piping Gives Long, Dependable Service

At B&W, quality control of Hollow Forgings is constant from initial melt to final inspection of the finished product. This *integrated* control is a big reason why B&W Hollow Forged Piping is the most practical choice for main steam, reheater, feedwater, and other heavy-duty high-pressure or high-temperature lines.

Testing at B&W includes analysis and grain structure examinations—hydrostatic test—and ultrasonic test as standard procedure. What's more, B&W machines the outside surface of every forging, to assure good appearance and ease of fabrication.

B&W Hollow Forged Piping is available in a wide range of sizes, in carbon, alloy and stainless grades, and is made to ASTM specifications. There is a size and grade close to your optimum design requirements. For more about how B&W Hollow Forgings meet your needs best, write for Bulletin S-16. The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

S-475-HF

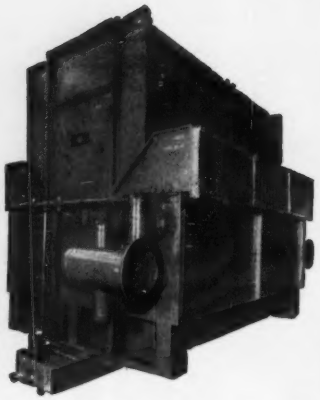
B&W

THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

For more facts circle 274 on Reader Service card, p 101

ECONOMICAL COOLING OF GASES AND COMPRESSED AIR



Cooling gases or cooling and removing moisture from compressed air, the Niagara *Aero* After Cooler offers the most economical and trustworthy method. Cooling by evaporation in a closed system, it brings the gas or compressed air to a point below the ambient temperature, effectively preventing further condensation of moisture in the air lines. It is a self-contained system, independent of any large cooling water supply, solving the problems of water supply and disposal.

Cooling-water savings and power-cost savings in operation return your equipment costs in less than two years. New sectional design reduces the first cost, saves you much money in freight, installation labor and upkeep. Niagara *Aero* After Cooler systems have proven most successful in large plant power and process installations and in air and gas liquefaction applications.

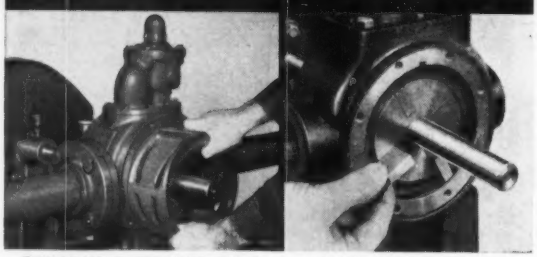
Write for Descriptive Bulletin 130.

NIAGARA BLOWER COMPANY

Dept. P-11, 405 Lexington Ave., New York 17, N.Y.

For more facts circle 275 on Reader Service card, p 101

REPLACING THESE PARTS AVE BUYING A WHOLE NEW PUMP



REPLACEABLE CYLINDER LINER REPLACEABLE VANES

With Blackmer rotary pumps, normal wear occurs on these easily replaceable parts. New vanes and cylinder liner can be installed quickly without disconnecting either the piping or the motor. Often, after years of service, you can make a Blackmer pump good as new for as little as 15% of the cost of a whole new pump. For more details, ask for Bulletin One.

"liquid materials handling"® equipment

BLACKMER

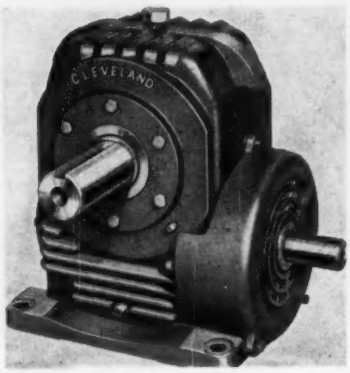
BLACKMER PUMP COMPANY, GRAND RAPIDS 9, MICH.

See Yellow pages for your local sales representative

For more facts circle 276 on Reader Service card, p 101

Equipment news

Begins on page 116



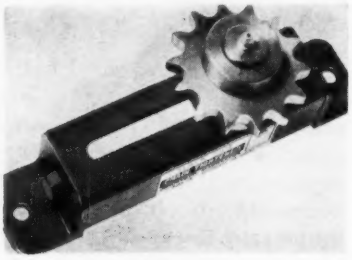
Fan-cooled speed reducer

45 • Higher-hp reducer has 1-piece cast iron housing for strength and heat dissipation. Cooling fan is mounted on input end of worm shaft and rotates in either direction. Units ranging from 1 to 40 hp are in production. Larger sizes are being tested.—Cleveland Worm & Gear Co

Bushing type ct

34 • External-mounted current transformer eliminates untanking and protective housing. Designed for circuit relaying, indicating or protection, it is installed on existing units by merely slipping ct down over a power bushing. This transformer can be used with any standard ASA bushing, 34.5 kv or below. —Allis-Chalmers Mfg Co

Just circle key numbers on the Reader Service card, page 101, to get complete product story



Chain tightener

42 • Device should reduce vibration, extend chain life while providing ample takeup. Units come in three stock sizes to fit standard chain. —Industrial Marketers

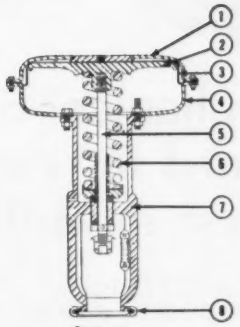
continued

THESE FEATURES

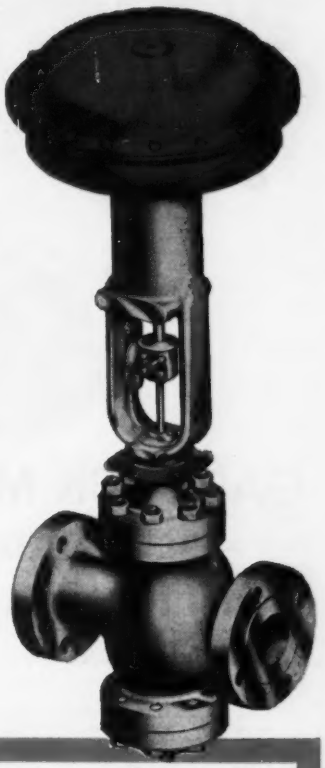
Make The BS&B *Super* 70

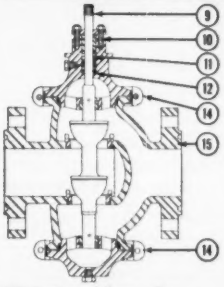
TODAY'S OUTSTANDING VALVE IN ITS CLASS!

BS&B Super 70 Control Valves are widely used with instruments to control pressures, temperatures, liquid levels and flow. They efficiently handle gas, air, vapor, steam or liquids in a wide variety of applications. Valve bodies are available with either the patented clamp ring —float ring closures—up to 600# ASA— or the conventional flanged-gasketed type closures in ratings up to 2500# ASA.

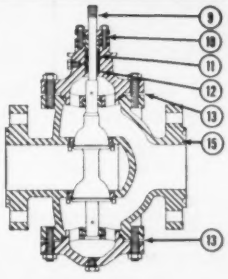


Actuator

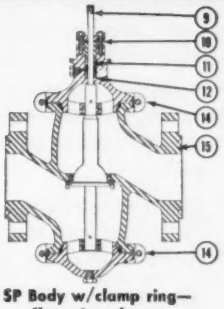




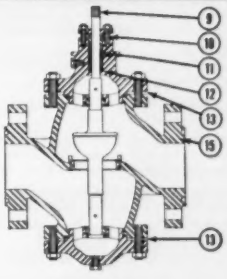
DP Body w/clamp ring—float ring closure



DP Body w/flanged-gasketed closure



SP Body w/clamp ring—float ring closure



SP Body w/flanged-gasketed closure

VALVE BODIES AND INNER VALVES REVERSIBLE WITHOUT ADDITIONAL PARTS

1. Direct, Reverse and Pressure Balanced Actuator
2. Diaphragm Plate of Ductile Iron
3. Moulded Diaphragm of Buna-N With Nylon Inserts
4. Pressed Carbon Steel Case
5. AISI 303 Stainless Steel Stem
6. Tempered Steel Spring, Precision Calibrated To Within ± 2%
7. Ductile Iron Yoke
8. 2-Piece Forged Steel Clamp Ring
9. Type 303 Stainless Steel Packing Follower
10. Heavy Duty Adjustable Bolted Construction
11. Teflon CVU, TA and GA Packing
12. Solid Cast, Step-Type Design
13. Flanged-Gasketed Closure
14. Clamp Ring—Float Ring Closure
15. High Capacity, Stable Flow Body

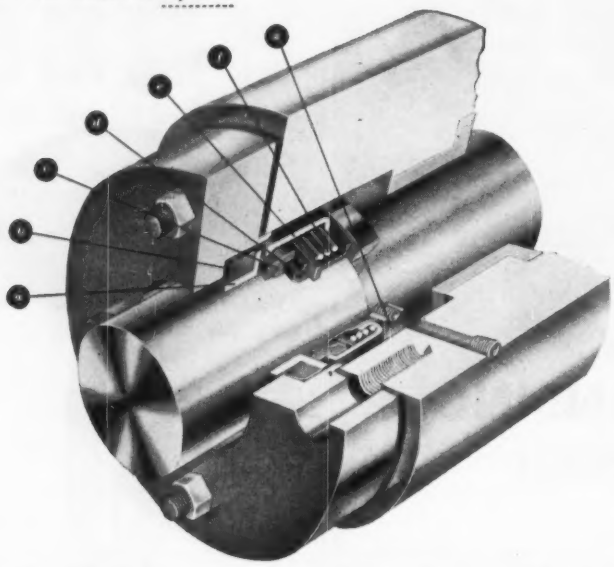
SUPER T.M. BS&B 70

For the location of your nearest BS&B Sales Office or Representative, consult your Chemical Engineering Catalog or Refinery Catalog. Or if you prefer, write directly to us for detailed information.

BLACK, SIVALLS & BRYSON, INC.
Controls Division, Dept. 4-Q11
7500 East 12th Street
Kansas City 26, Missouri

For more facts circle 277 on Reader Service card, p 101

ONE OF THE GARLOCK **2,000**



GARLOCK Mechanical Seals —self-contained for easy installation, less downtime

a. ***Stationary Seat*** *of ceramic, Ni Resist, or bronze has precision lapped sealing face for perfect contact with carbon ring.*

b. ***Vibration Ring*** *of Buna-N positions stationary seat in a flexible mounting and acts as static seal.*

c. ***Seal Ring*** *of carbon is also precisely lapped to match sealing face of stationary seat.*

d. ***Roll type Bellows*** *permits free movement of seal ring.*

e. ***Shell,*** *encases entire rotary unit and furnishes mechanical drive for seal ring.*

f. ***Stainless Steel Spring*** *with load precisely calculated to face area of seal.*

g. ***Stop Collar,*** *or shoulder, positions seal to specified operating length.*

Garlock's PK MECHANIPAK* is designed to avoid excessive downtime. Self-contained, it can be installed simply and quickly, and eliminates adjustment during operation. Seal life is equal to many sets of conventional packings. Check these additional advantages:

Leak-proof sealing. Sealing faces of rotating and stationary parts are precision lapped for perfect contact, thus preventing leakage.

Elimination of shaft wear. No parts of the seal move on the shaft or sleeve, thus removing the danger of scoring or wear.

Maximum operating conditions are 212° F temperature, 150 psi pressure, 2000 fpm shaft speed. Available in shaft sizes from ⅜" to 3", PK MECHANIPAK Seals are another of the Garlock 2,000 . . . two thousand different styles of packings, gaskets, and seals for every need. Find out more by talking with your local Garlock representative, or write for Catalog AD-150.

*Registered Trade Mark

THE GARLOCK PACKING COMPANY, Palmyra, N.Y.

FOR PROMPT SERVICE, contact one of our 26 sales offices and warehouses throughout the U.S. and Canada.

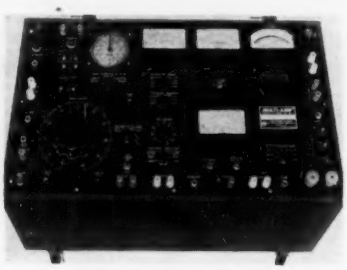
GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Molded and Extruded Rubber, Plastic Products

CANADIAN DIVISION: The Garlock Packing Co. of Canada Ltd.
PLASTICS DIVISION: United States Gasket Company

Equipment news

Begins on page 116



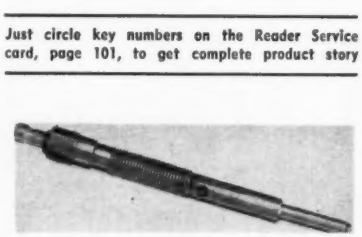
Relay tester

36 • This unit is designed for testing a full range of ac and voltage-activated relays, circuit breakers, current transformers and insulation resistance to such equipment. The 2-kva, 240- or 120-v, 60-cycle single-phase tester has a continuously adjustable transformer for current or voltage load. Dc target and seal-in relays can also be checked. Tester is enclosed in a steel case mounted on casters and provided with handles.—Multi-Amp Electronic Corp

Portable cord reel

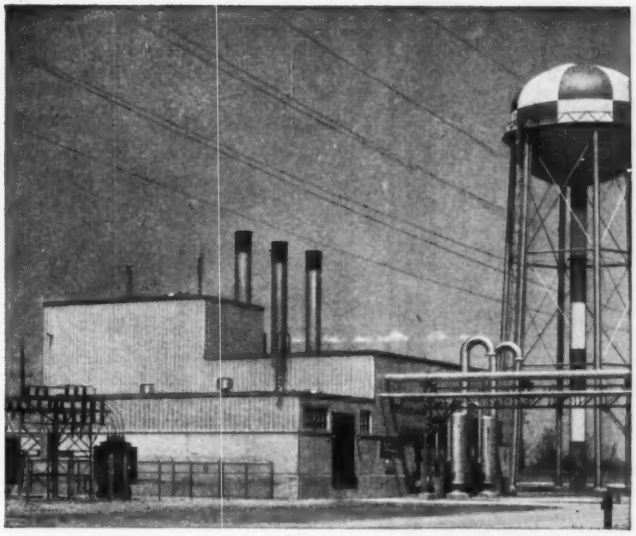
26 • Many power outlets from one power source are provided by this unit, *Model 910.* Having a cord capacity of up to 375 ft, reel has a heavy steel frame, carrying handle and rewind knob. — Daniel Woodhead Company

Just circle key numbers on the Reader Service card, page 101, to get complete product story

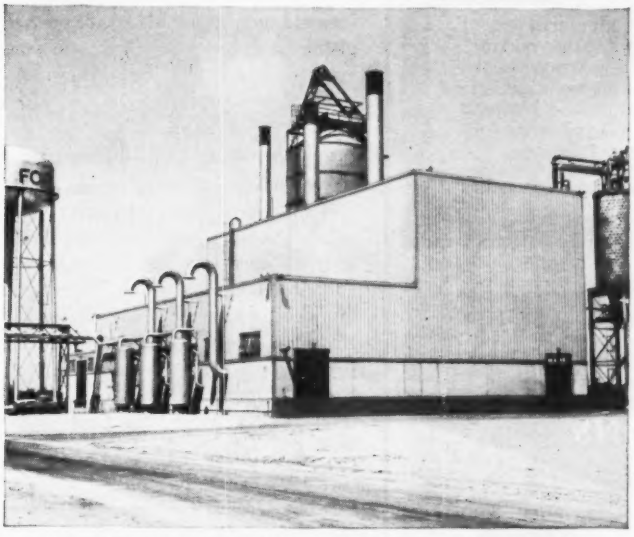


Diesel starting aid

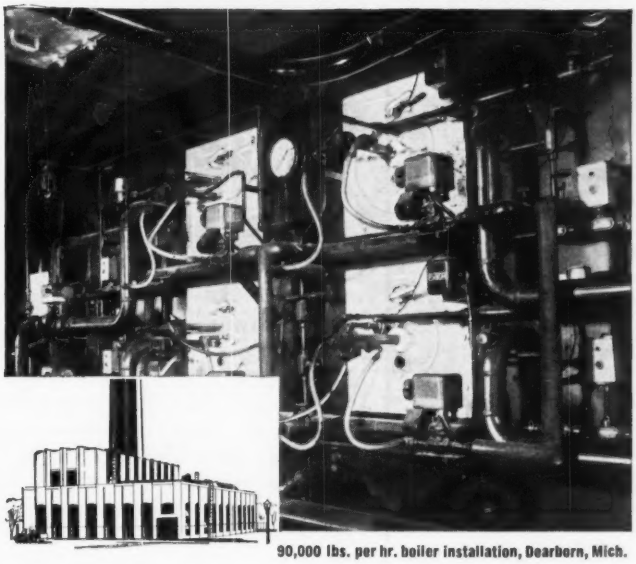
50 • Cold-weather-starting aid is a pencil-like heating device which screws into combustion chambers. You simply push a button on the dash and hold for two to three minutes. Power from the battery raises surface temperature of the heating element to 1800 to 2000 F, heating the fuel to permit easy ignition. Device is sheathed in Inconel tubing to prevent scaling and embrittlement by high temperatures and carbon deposits.—Superior Tube Co continued



Steam and compressed air plant, Rawsonville, Michigan. Total capacity: 120,000 lbs. per hr.



Steam and compressed air plant, Indianapolis. Total capacity: 300,000 lbs. per hr.



90,000 lbs. per hr. boiler installation, Dearborn, Mich.

FORD POWERS UP with Pritchard-built power plants

What's the most important factor in an industrial power plant? Efficiency? Low investment cost?

The Ford Motor Co. will tell you it's neither factor—when considered separately. The highly efficient plant may have cost so much to build that its products—steam and air—are too expensive for the highly competitive automobile manufacturing business. On the other hand, the low cost plant may never operate efficiently and may be subject to frequent break-downs.

The first power plant built for Ford by J. F. Pritchard & Co. has shown a favorable operating cost-investment cost ratio. Since then, two more Ford power construction jobs have been completed by Pritchard.

Balancing investment costs with operating costs is basic to Pritchard's approach to power plant construction. This requires more than engineering skill alone—more than good construction—more than careful purchasing and coordination. It combines these factors in such a way that the completed plant costs least to own and operate in the long run.

If you are considering expansion or new construction, assign the job to Pritchard. Our services range from economic surveys to completion of turn-key jobs . . . our experience from the construction of industrial power plants to central stations.

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ENGINEERS • CONSTRUCTORS

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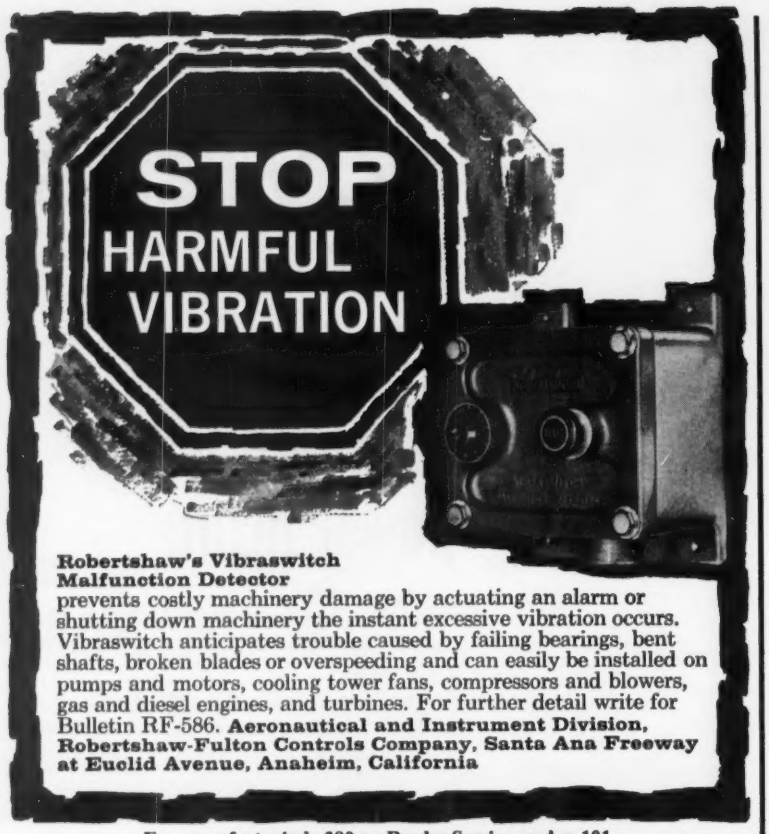
SERVING THE GAS, POWER, PETROLEUM AND CHEMICAL INDUSTRIES

For more facts circle 279 on Reader Service card, p 101



Robertshaw's Vibraswitch Malfunction Detector
prevents costly machinery damage by actuating an alarm or shutting down machinery the instant excessive vibration occurs. Vibraswitch anticipates trouble caused by failing bearings, bent shafts, broken blades or overspeeding and can easily be installed on pumps and motors, cooling tower fans, compressors and blowers, gas and diesel engines, and turbines. For further detail write for Bulletin RF-586. **Aeronautical and Instrument Division, Robertshaw-Fulton Controls Company, Santa Ana Freeway at Euclid Avenue, Anaheim, California**

For more facts circle 280 on Reader Service card, p 101

5 INTERCHANGEABLE HELICAL GEAR REDUCTIONS

(Fig. 288)

Viking Pumps

Capacities from 17 to 164 G.P.M.

You have four pump sizes and a wide range of speeds available, with these new Viking heavy duty pumps . . . because of the five easily interchanged helical gear reductions. By changing gear reductions, you can handle liquids ranging in viscosity from Bunker C to fuel oil.

These new reduction units also make pumps narrower and lower . . . able to fit into smaller space. Gears run in oil. Reducing units are mounted separately — not supported on pumps or motor shafts.

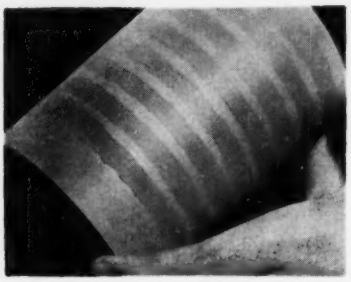
For full information on these new, compact reducing units, write today for Catalog CW, Pages 27-28

VIKING PUMP COMPANY
Cedar Falls, Iowa, U.S.A. In Canada, it's "ROTO-KING" pumps

See Our Catalog in Sweet's Industrial Construction and Plant Engineer's File

Equipment news

Begins on page 116



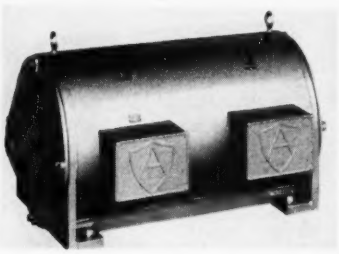
Aluminum castings

48 • Aluminum castings and forgings with precision-welded zones of super-hardness and wear resistance are said to retain this hardness even at very high temperatures. Prospects for aluminum welding alloys are piston-ring grooves, brake drums, valve seats and sheaves.—Aluminum Company of America

Steam-trap replacement

31 • One-piece cage replacement unit for thermostatic traps up to 250 psig has seat plug of universal-jointed stainless-steel ball, factory calibrated and preset in unalterable alignment. Monel cage protects bellows from erosive condensate flow. Replacement operation is simple — remove trap cover, remove worn thermostatic-unit pieces, insert cage-replacement unit and recover the repaired trap. —Barnes & Jones, Inc

Just circle key numbers on the Reader Service card, page 101, to get complete product story



Motor-alternator

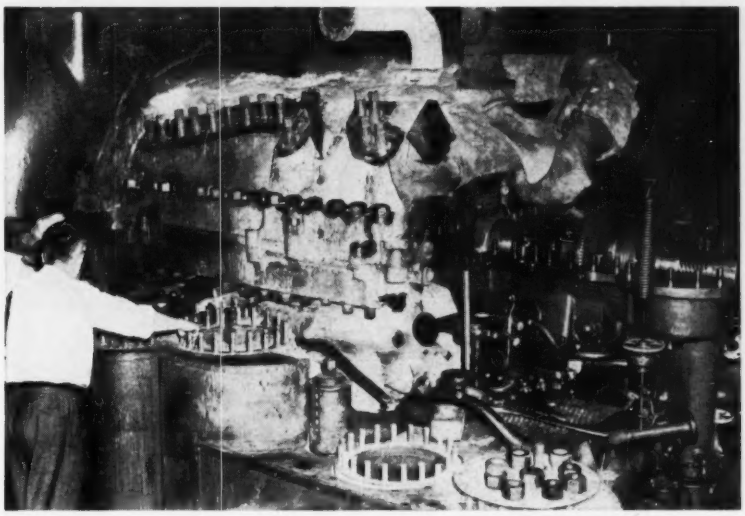
30 • One-piece rotor and cast windings combine with brushless design to make this inductor type alternator almost maintenance free, states manufacturer. Two-bearing common-shaft 400-cycle models from 500 w to 10 kva can be furnished.—American Electronics, Inc

For more facts circle 281 on Reader Service card, p 101

MOLYKOTE® LUBRICANT POWER NEWS

PRACTICALLY 100% PROTECTION AGAINST THE GALLING AND SEIZING OF ALL HIGH TEMPERATURE THREADED CONNECTIONS

MOLYKOTE TYPE G IS BEST THREAD LUBRICANT AVAILABLE



Hundreds of threaded connections in a turbine are subjected to temperatures which may go as high as 1100°F.

Every power engineer realizes that the extreme bearing pressure in a threaded connection is carried at a series of contact points on the mating surfaces of the threads. The number of these contact points increases with load. Since these contact points are not spaced symmetrically about the thread circumference, off-center loads increase the severity of the contact pressures and frictional conditions.

Liquid lubricants are ineffective under these load conditions and seizing and galling often occur when make-up or break-away torque is applied.

MOLYKOTE exhibits the lowest coefficient of friction of all solids at extreme bearing pressures and offers the highest resistance against galling and seizing. Because of its strong affinity for attachment to metal, it cannot be wiped off. MOLYKOTE used in threaded connections remains effective at temperatures in excess of 1100°F. The saving in damage to threaded connections in the power industry runs into fantastic figures.

When writing, refer to Item 510

LEADING POWER EQUIPMENT MANUFACTURERS SPECIFY MOLYKOTE FOR MACHINERY WEAR-IN

Leading power equipment builders have found after years of experience that the use of MOLYKOTE Lubricants is their best guarantee against breaking-in damage. Costly service calls to refinish damaged parts have been eliminated. During reassembly, after overhaul, MOLYKOTE WEAR-IN COMPOUND provides the same basic guarantee of dependable service.

When writing, refer to Item 511

REPRINT AVAILABLE

"SOLID LUBRICANTS . . ." *an 8-page reprint from the Nov. 1958 issue of POWER, is available until supply is exhausted.*

MOLYKOTE TYPE Z UNAFFECTED BY RADIATION

Used in Critical Areas of Latest Nuclear Power Plants for Lifetime Lubrication

The nuclear power plant has complicated lubrication problems. Not only must lubricants operate over a wide temperature range, but they must be unaffected by radiation and, in many cases, must provide lifetime lubrication because of the inaccessibility of parts and the danger involved in servicing reactors.

More than a decade ago, scientists working for the Atomic Energy Commission discovered that MOLYKOTE Type Z was unaffected by radiation and they used it to lubricate equipment subjected to intense radiation. During the development and testing of nuclear power plants for atomic submarines, MOLYKOTE Type Z was specified by the designers and used extensively.

Today, more than ever, with the development of atomic reactors for the power industry, more emphasis is being placed upon the vital quality of lifetime lubrication and MOLYKOTE is being called upon to play a part which is continually increasing in importance.

When writing, refer to Item 509

MOLYKOTE TYPE Z REDUCES SERVICING OF EQUIPMENT

MOLYKOTE Type Z powder is being used on timing devices, Variacs, rheostats, knife switches and circuit breakers where conventional lubricants gather dust or tend to become gummy.

In many applications it has been noticed that pitting and oxidation of contact points was considerably reduced after MOLYKOTE Type Z was applied. Countless man-hours are saved in cleaning, adjusting and lubricating electrical contacts and relays.

When writing, refer to Item 512

Address your letter to The Alpha-Molykote Corp., 65 Harvard Ave., Stamford, Conn.
Phone: FIreside 8-3724.

SEE OUR CATALOG IN SWEET'S PRODUCT DESIGN FILE

THE ALPHA-MOLYKOTE CORP.
Stamford, Connecticut
Please send me details on

Item 509 ☐ **Item 510** ☐ **Item 511** ☐ **Item 512** ☐

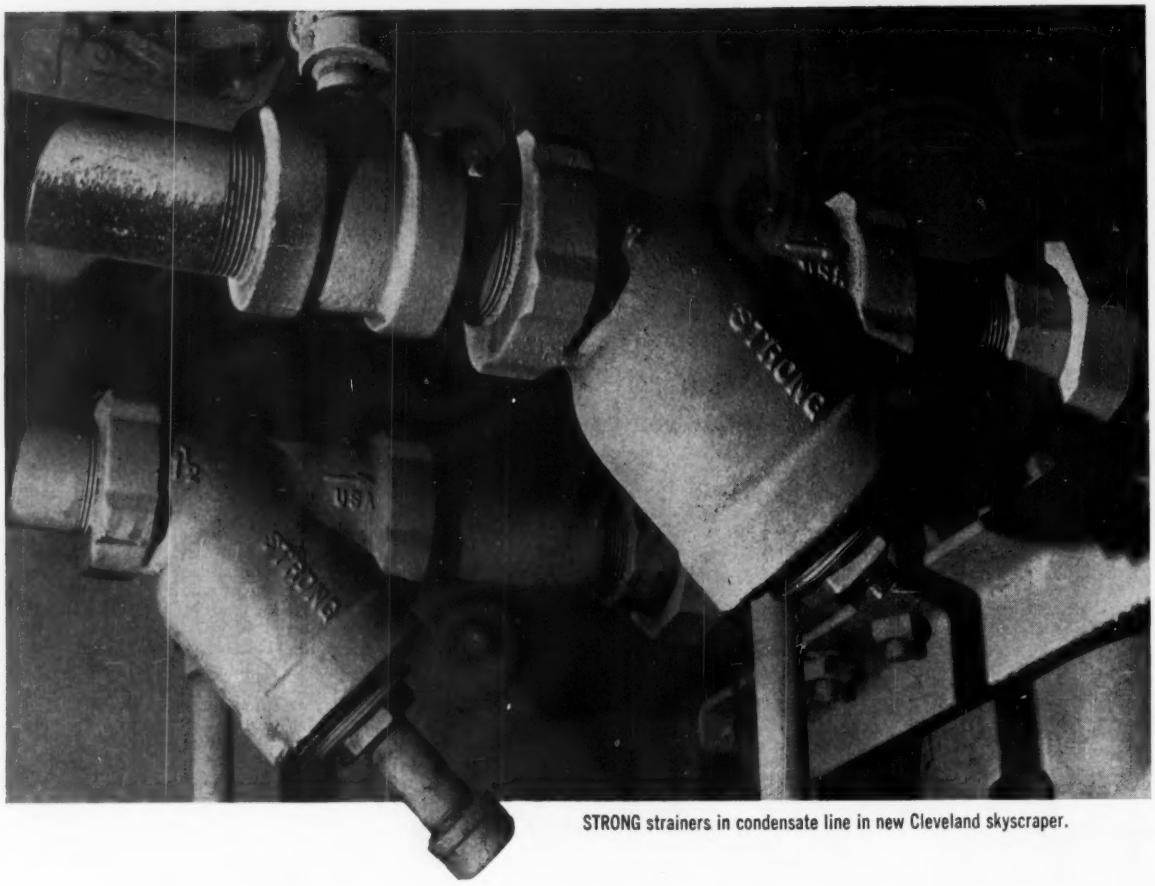
Name _____
Company _____
Address _____
City _____
State _____

THE ALPHA-MOLYKOTE CORPORATION

BREAKING LUBRICATION BARRIERS

. . . THROUGH RESEARCH

For more facts circle 282 on Reader Service card, p 101



STRONG strainers in condensate line in new Cleveland skyscraper.

select the STRONG® strainer *designed for you!*

IN steam, air, gas, water, oil or chemical systems, a *correctly selected* strainer pays for itself many times. It protects expensive equipment (traps, control instruments, meters, etc.) and reduces over-all maintenance and service costs.

Assure your system maximum protection from dirt, scale, sludge and sediment . . . specify *the* STRONG strainer designed for your requirements.

Sizes: from ¼″ to 8″

Service: 250 psi at 450° F to 2500 psi at 1100° F

Screens: stainless screens with .027″, .045″, .062″, or .125″ perforations (at no extra cost)

Types: "Y" or Angle with screwed or socket-weld (flanged) connections

Materials: semi-steel, ductile-iron, bronze, Monel, cast or block steel, or new all-stainless or Hasteloy

STRONG'S extensive line of rugged, high-quality strainers are available from your local STRONG distributor. Contact him for assistance in selecting the *right* strainer, or write for your copy of STRONG Bulletin SS—21C.

STRONG, CARLISLE & HAMMOND

508 Sandusky Street, Conneaut, Ohio

air traps • strainers • reducing valves • vacuum or pumping traps
continuous blowdown valves • separators • engine stops • F and T traps • safety headgear

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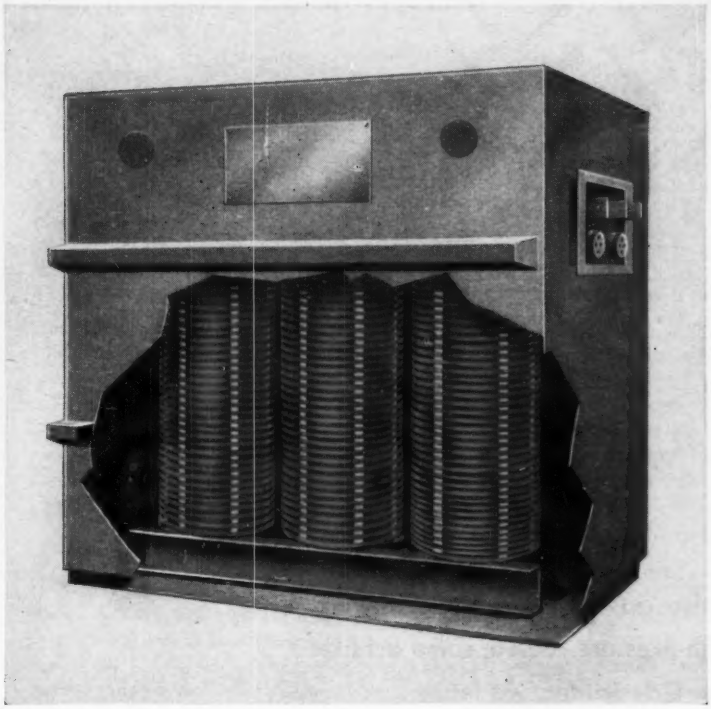
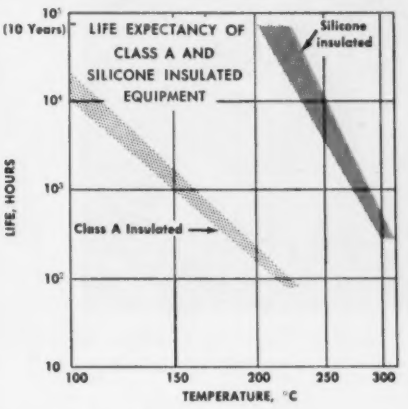
SILICONE NEWS from Dow Corning

The Inside Story on Costs





Look Deeper than the Surface When Specifying Transformers

What a transformer will or won't do . . . its installation and maintenance costs . . . are determined to a large degree by its insulation.

You can assure these four cost-saving factors by specifying a silicone insulation system:

Lowest Cost Installation: Easier to handle and easier to install, they require no costly vaults or barriers . . . can be placed right at load or load center for additional savings on costly low-voltage cable. Silicone insulated dry-types are up to 40% lighter than non-inflammable liquid filled units. Minimum floor loading means least costly supporting structure.

Lower Operating and Maintenance Costs: Virtually maintenance-free, silicone insulated transformers have no liquids to filter or change. Need no space heaters to keep windings dry when de-energized.

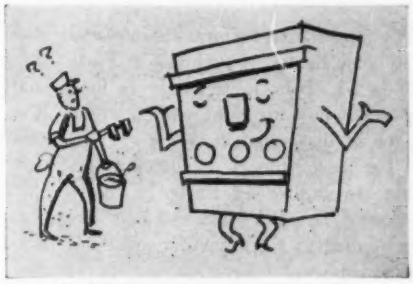
Maximum Safety: Completely dry, they're completely safe! No danger of fire . . . no toxic fumes. Silicone insulated transformers have proved safe under extreme overload and short circuit conditions.

Maximum Reliability: Depending on design, they withstand overloads of 25% to 50% and more above rated capacity. The extra thermal capacity of silicones, demonstrated by the curves in the next column, assures uninterrupted, reliable power.

Today, transformer manufacturers offer two basic designs insulated with Dow Corning Silicones—sealed dry-types and open dry-types.

For power station auxiliaries, you can achieve maximum reliability and minimum maintenance with a silicone-insulated sealed dry-type unit. Requires only a periodic check of pressure gauge and bushings. Or you can save weight by specifying a silicone-insulated open dry-type unit . . . it's ideal for balconies and other minimum floor loading areas.

For underground distribution systems, select a silicone-insulated sealed dry-type network transformer. Fits easily into existing vaults. Undamaged even if flooded, only the bushings, pressure gauge and case need infrequent inspection.



Sealed dry-type transformers require virtually no upkeep.

Send today for full information on silicone-insulated, dry-type transformers and list of manufacturers offering equipment insulated with Dow Corning Silicones. Address Dept. 6923

SPECIFY Dow Corning Silicones and **SAVE!**

first in silicones

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MIDLAND, MICHIGAN

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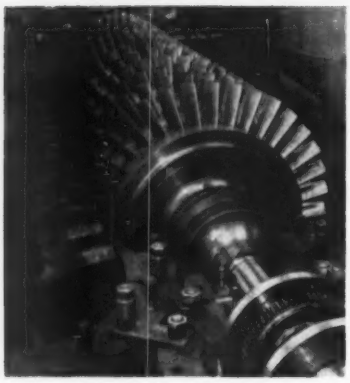
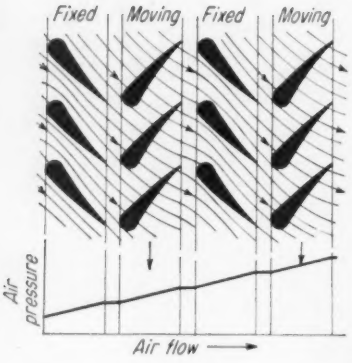
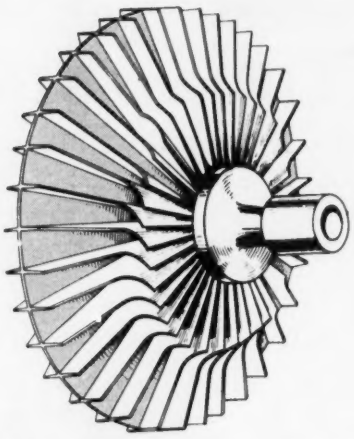


1 Axial-flow compressor resembles turbine in arrangement of rotor, casing



2 Axial-flow blading uses sections of air foils to work with best efficiency



3 Single-stage centrifugal compressor impeller has radial blades to handle air

THERMO REFRESHER NO. 32

By B G A SKROTZKI, Associate Editor

Steady-flow compressors raise gas pressure while moving gas from low-pressure to high-pressure region; some act like reversed turbines. Using the *Gas Tables*, we learn . . .

How to figure gas processes accurately

We studied gas-turbine engines and the basic theory of turbines in Parts 26 to 31. Now we're ready to look at steady-flow air compressors, which some of these engines use.

The basic theory of compressors that we studied in Parts 14 to 16 (POWER, Dec 1957, Jan and Feb '58) as applied to reciprocating machines also applies to the wide variety of steady-flow compressors.

Axial-flow compressors, Fig. 1, have a rotor carrying blades that pass between stationary blades carried by the casing. Fig. 2 shows a cross section of two stages of this type compressor. The blades are airfoil sections, designed on aerodynamic principles to reduce friction and turbulence.

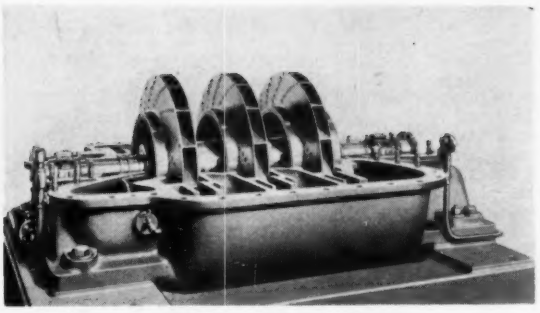
In Fig. 2 streamlines with arrows show the direction of air flow through the two stages. The fixed blades form diffusers. These act oppositely to nozzles; they receive a high-speed gas flow through their narrow end, slow it down because of the widening cross section and so allow it to compress itself to a higher pressure before leaving the larger end. In effect, the gas molecules entering catch up with molecules ahead and so raise the density and pressure.

The moving blades "bite" into the gas stream and "push" it along the general direction of the diffuser axes. Blades strike the individual gas molecules and "bat" them along to increase their speed and energy. That is, the blades do work on the gas. When the molecules "catch up" with each other (as a continuous process) in the diffusers they produce a higher pressure and have a higher temperature.

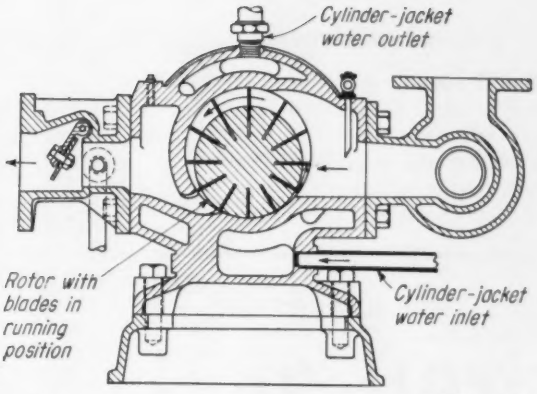
The basic molecular action in the axial-flow compressor resembles that in a piston and cylinder, difference being that flow and compression is continuous in the former and intermittent in the latter. Gas flows in a generally helical path around the rotor for the blade arrangement shown in Fig. 2. Other blading angles may be used.

Centrifugal compressors, Fig. 4, are another form of steady-flow pressurizer. In the 3-stage unit shown, also called a blower, air enters the casing at left, then enters the center annular space of the first-stage impeller. Curved blades (outlined by the welding marks) work on the gas, giving it more energy by exerting a centrifugal force on it.

Gas leaves the impeller periphery to enter surrounding diffusing passages in the casing. Here the gas slows down as its pressure rises, and the passages lead it to center inlet of the second stage. In this fashion



4 Three-stage centrifugal compressor has three shrouded impellers carrying curved blades to pressurize large air volumes



5 Rotary compressor with sliding vanes forms chambers that shrink in volume as rotor turns from inlet to outlet ports

gas pressure and temperature rise in three steps before gas leaves the outlet at right.

Fig. 3 shows another form of centrifugal compressor rotor or impeller. This one runs inside a close-fitting casing that has an opening around the inner portion where the radial fins or blades are curved. The casing holds a diffusing passage surrounding the entire periphery of the impeller. Gas enters between the curved portions of the radial blades (impeller turns counterclockwise) and is forced out by centrifugal action of the blades to enter the diffuser in which it is pressurized.

Rotary compressors built in several forms also may be considered steady-flow devices, though they handle gas in batches, rather than in a truly steady stream. Fig. 6 shows a compressor with two rotors, each having two lobes that continuously touch each other as they turn. With clockwise rotation of the left rotor and counterclockwise of the other, air is carried from bottom to top of the casing.

Spaces between the rotors and casing trap the gas at its inlet pressure. Forcing the incoming gas into the higher-pressure region produces pressurization. Close-contact fits between rotors and casing prevent gas from leaking back into the low-pressure source. In effect, compressor "packs" the high-pressure region with gas to produce higher pressure.

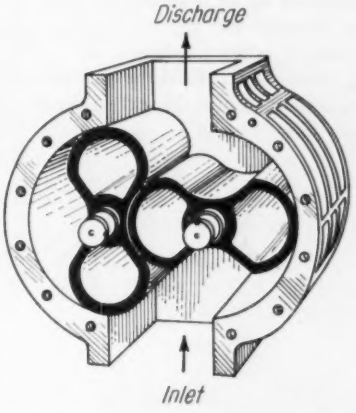
Fig. 5 shows a sliding-vane compressor; it has a rotor turning in a cylinder, the rotor axis being lower than the cylinder axis. Rotor carries spring-loaded vanes that rub along the surface of the cylinder forming leakproof chambers that vary in volume as the rotor turns.

Entering gas gets trapped in these chambers in the upper part of the cylinder. As the rotor turns the chamber volume shrinks and compresses the gas. At the lower left port the chambers discharge the compressed gas to the high-pressure region. Flush fit between lower part of the rotor and cylinder prevent h-p gas from leaking back to the inlet.

Gas tables. In the energy and work equations, Parts 5 through 8 (Jan, Feb, April, May 1957), specific heats of the gas play an important part. Easiest way to use these equations is to assume that the specific heats (or their ratio k) stay constant for the conditions considered. But Part 5 showed that temperature and pressure change the values of c_p, c_v and k. So where we need to do accurate work the variation in these factors must be taken into account.

To avoid involved computations using integral calculus Keenan and Kaye compiled the *Gas Tables*. An abstract of the table for air at 1-psia pressure is reproduced on the next page. This table is accurate enough for most thermodynamic design work. When used for pressures above 400 psia the errors in calculating may be on the order of ½% or less.

The complete *Gas Tables* include 64 tables for a variety of gases and their mixtures as well as certain



6 Positive-displacement rotary blower "packs" air into high-pressure region

mathematical quantities. Let's learn how to use the air table; the original table has 1-deg intervals to 3000 °R and 10-deg intervals to 6500 °R. Using the abstract table here won't give us the accuracy of the original—for important work use the original tables.

Constant-entropy processes are the foundation of the gas table. In the table the pressure and temperature at the beginning of a constant-entropy process are related to the pressure and temperature at the end of the process through the ratio of the relative pressures, p_r.

Example 1: Air at the start of a constant-entropy compression process is at 14.7 psia and 550 °R. If the process ends at 850 °R what is the corresponding pressure?

From the table, at 550 °R find

Gas *Table* legend

T = absolute air temperature, °R
h = enthalpy, Btu per lb air
p_r = relative pressure
u = internal energy, Btu per lb air
v_r = relative volume
ϕ = entropy at constant pressure

$p_{r1} = 1.4779$; at 850 °R find $p_{r2} = 6.856$, then:

$$\frac{P_2}{P_1} = \frac{p_{r2}}{p_{r1}}$$

$$P_2 = 14.7 \times \frac{6.856}{1.4779} = 68.2 \text{ psia}$$

Temperatures and specific volumes of air at beginning and end of a process are related through the ratio of relative volumes, v_r.

Example 2: Find the specific volume of the air at the end of the process described in Example 1.

$$V_1 = \frac{RT_1}{144P_1} = \frac{53.37 \times 550}{144 \times 14.7}$$
$$= 13.86 \text{ cu ft per lb}$$

From the table, at 550 °R find $v_{r1} = 137.85$; at 850 °R find $v_{r2} = 45.92$, then:

$$\frac{V_1}{V_2} = \frac{v_{r2}}{v_{r1}}$$

$$V_2 = 13.86 \times \frac{45.92}{137.85}$$
$$= 4.617 \text{ cu ft per lb}$$

Example 3: What work has been done on the air in the constant-entropy process of Example 1?

Work done on the air

$W = h_2 - h_1$

From the table corresponding to 550 and 850 °R find $h_1 = 131.46$ and $h_2 = 204.01$, so

$W = 204.01 - 131.46$
$= 72.55$ Btu per lb air

Example 4: What is the change of entropy of process in Example 1?

By definition $\Delta S = 0$. To check this from the table corresponding to 550 and 850 °R find $\phi_1 = 0.60518$ and $\phi_2 = 0.71037$; then

$$S_2 - S_1 = (\phi_2 - \phi_1) - \frac{R}{J} \log_e \frac{P_2}{P_1}$$
$$= 0.71037 - 0.60518 - \frac{53.37}{778.16} \log_e \frac{68.2}{14.7}$$
$$= 0.10519 - 0.686 \log_e 4.64$$
$$= 0.10519 - 0.10519 = 0$$

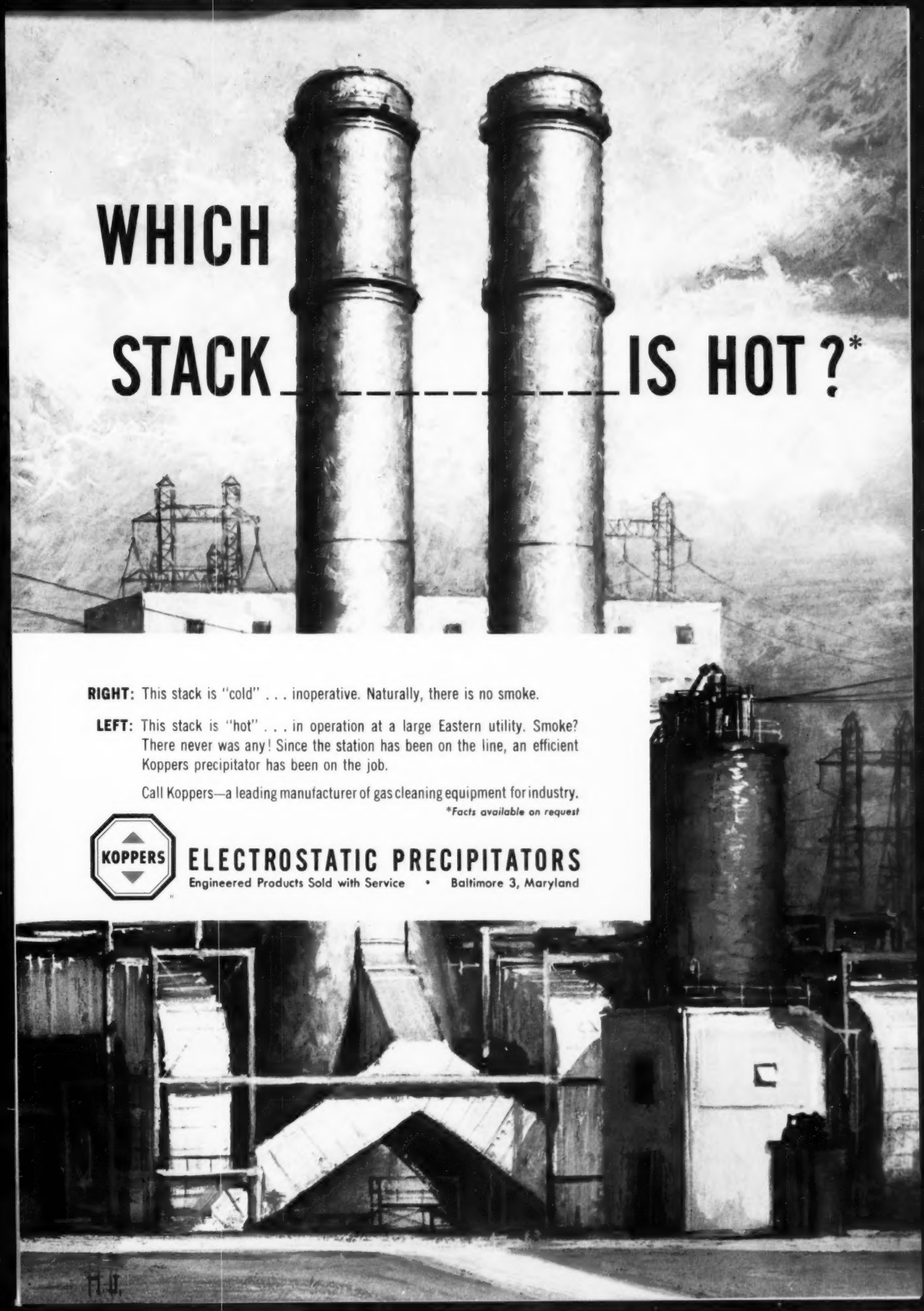
Next part will cover mixture of gases and combustion—in a forthcoming issue.

Thermodynamic properties of air (temperature)[a]

T	h	p_r	u	v_r	ϕ	T	h	p_r	u	v_r	ϕ
400	95.53	0.4858	68.11	305.0	0.52890	1160	281.14	21.18	201.63	20.293	0.78767
410	97.93	0.5295	69.82	286.8	0.53481	1170	283.68	21.86	203.49	19.828	0.78985
420	100.32	0.5760	71.52	270.1	0.54058	1180	286.21	22.56	205.33	19.377	0.79201
430	102.71	0.6253	73.23	254.7	0.54621	1190	288.76	23.28	207.19	18.940	0.79415
440	105.11	0.6776	74.93	240.6	0.55172	1200	291.30	24.01	209.05	18.514	0.79628
450	107.50	0.7329	76.65	227.45	0.55710	1210	293.86	24.76	210.92	18.102	0.79840
460	109.90	0.7913	78.36	215.33	0.56235	1220	296.41	25.53	212.78	17.700	0.80050
470	112.30	0.8531	80.07	204.08	0.56751	1230	298.96	26.32	214.65	17.311	0.80258
480	114.69	0.9182	81.77	193.65	0.57255	1240	301.52	27.13	216.53	16.932	0.80466
490	117.08	0.9868	83.49	183.94	0.57749	1250	304.08	27.96	218.40	16.563	0.80672
500	119.48	1.0590	85.20	174.90	0.58233	1260	306.65	28.80	220.28	16.205	0.80876
510	121.87	1.1349	86.92	166.46	0.58707	1270	309.22	29.67	222.16	15.857	0.81079
520	124.27	1.2147	88.62	158.58	0.59173	1280	311.79	30.55	224.05	15.518	0.81280
530	126.66	1.2983	90.34	151.22	0.59630	1290	314.36	31.46	225.93	15.189	0.81481
540	129.06	1.3860	92.04	144.32	0.60078	1300	316.94	32.39	227.83	14.868	0.81680
550	131.46	1.4779	93.76	137.85	0.60518	1310	319.53	33.34	229.73	14.557	0.81878
560	133.86	1.5742	95.47	131.78	0.60950	1320	322.11	34.31	231.63	14.253	0.82075
570	136.26	1.6748	97.19	126.08	0.61376	1330	324.69	35.30	233.52	13.958	0.82270
580	138.66	1.7800	98.90	120.70	0.61793	1340	327.29	36.31	235.43	13.670	0.82464
590	141.06	1.8899	100.62	115.65	0.62204	1350	329.88	37.35	237.34	13.391	0.82658
600	143.47	2.005	102.34	110.88	0.62607	1360	332.48	38.41	239.25	13.118	0.82848
610	145.88	2.124	104.06	106.38	0.63005	1370	335.09	39.49	241.17	12.851	0.83039
620	148.28	2.249	105.78	102.12	0.63395	1380	337.68	40.59	243.08	12.593	0.83229
630	150.68	2.379	107.50	98.11	0.63781	1390	340.29	41.73	245.00	12.340	0.83417
640	153.09	2.514	109.21	94.30	0.64159	1400	342.90	42.88	246.93	12.095	0.83604
650	155.50	2.655	110.94	90.69	0.64533	1410	345.52	44.06	248.86	11.855	0.83790
660	157.92	2.801	112.67	87.27	0.64902	1420	348.14	45.26	250.79	11.622	0.83975
670	160.33	2.953	114.40	84.03	0.65263	1430	350.75	46.49	252.72	11.394	0.84158
680	162.73	3.111	116.12	80.96	0.65621	1440	353.37	47.75	254.66	11.172	0.84341
690	165.15	3.276	117.85	78.03	0.65973	1450	356.00	49.03	256.60	10.954	0.84523
700	167.56	3.446	119.58	75.25	0.66321	1460	358.63	50.34	258.54	10.743	0.84704
710	169.98	3.623	121.32	72.60	0.66664	1470	361.27	51.68	260.49	10.537	0.84884
720	172.39	3.806	123.04	70.07	0.67002	1480	363.89	53.04	262.44	10.336	0.85062
730	174.82	3.996	124.78	67.67	0.67335	1490	366.53	54.43	264.38	10.140	0.85239
740	177.23	4.193	126.51	65.38	0.67665	1500	369.17	55.86	266.34	9.948	0.85416
750	179.66	4.396	128.25	63.20	0.67991	1550	382.42	63.40	276.17	9.056	0.86285
760	182.08	4.607	129.99	61.10	0.68312	1600	395.74	71.73	286.06	8.263	0.87130
770	184.51	4.826	131.73	59.11	0.68629	1650	409.13	80.89	296.03	7.556	0.87954
780	186.94	5.051	133.47	57.20	0.68942	1700	422.59	90.95	306.06	6.924	0.88758
790	189.38	5.285	135.22	55.38	0.69251	1750	436.12	101.98	316.16	6.357	0.89542
800	191.81	5.526	136.97	53.63	0.69558	1800	449.71	114.03	326.32	5.847	0.90308
810	194.25	5.775	138.72	51.96	0.69860	1850	463.37	127.18	336.55	5.388	0.91056
820	196.69	6.033	140.47	50.35	0.70160	1900	477.09	141.51	346.85	4.974	0.91788
830	199.12	6.299	142.22	48.81	0.70455	1950	490.88	157.10	357.20	4.598	0.92504
840	201.56	6.573	143.98	47.34	0.70747	2000	504.71	174.00	367.61	4.258	0.93205
850	204.01	6.856	145.74	45.92	0.71037	2100	532.55	212.1	388.60	3.667	0.94564
860	206.46	7.149	147.50	44.57	0.71323	2200	560.59	256.6	409.78	3.176	0.95868
870	208.90	7.450	149.27	43.26	0.71606	2300	588.82	308.1	431.16	2.765	0.97123
880	211.35	7.761	151.02	42.01	0.71886	2400	617.22	367.6	452.70	2.419	0.98331
890	213.80	8.081	152.80	40.80	0.72163	2500	645.78	435.7	474.40	2.125	0.99497
900	216.26	8.411	154.57	39.64	0.72438	2600	674.49	513.5	496.26	1.8756	1.00623
910	218.72	8.752	156.34	38.52	0.72710	2700	703.35	601.9	518.26	1.6617	1.01712
920	221.18	9.102	158.12	37.44	0.72979	2800	732.33	702.0	540.40	1.4775	1.02767
930	223.64	9.463	159.89	36.41	0.73245	2900	761.45	814.8	562.66	1.3184	1.03788
940	226.11	9.834	161.68	35.41	0.73509	3000	790.68	941.4	585.04	1.1803	1.04779
950	228.58	10.216	163.46	34.45	0.73771	3100	820.03	1083.4	607.53	1.0600	1.05741
960	231.06	10 610	165.26	33.52	0.74030	3200	849.48	1241.7	630.12	0.9546	1.06676
970	233.53	11.014	167.05	32.63	0.74287	3300	879.02	1418.0	652.81	0.8621	1.07585
980	236.02	11.430	168.83	31.76	0.74540	3400	908.66	1613.2	675.60	0.7807	1.08470
990	238.50	11.858	170.63	30.92	0.74792	3500	938.40	1829.3	698.48	0.7087	1.09332
1000	240.98	12.298	172.43	30.12	0.75042	3600	968.21	2067.9	721.44	0.6449	1.10172
1010	243.48	12.751	174.24	29.34	0.75290	3700	998.11	2330.3	744.48	0.5882	1.10991
1020	245.97	13.215	176.04	28.59	0.75536	3800	1028.09	2618.4	767.60	0.5376	1.11791
1030	248.45	13.692	177.84	27.87	0.75778	3900	1058.14	2934.4	790.80	0.4923	1.12571
1040	250.95	14.182	179.66	27.17	0.76019	4000	1088.26	3280	814.05	0.4518	1.13334
1050	253.45	14.686	181.47	26.48	0.76259	4100	1118.46	3656	837.40	0.4154	1.14079
1060	255.96	15.203	183.29	25.82	0.76496	4200	1148.72	4067	860.81	0.3826	1.14809
1070	258.47	15.734	185.10	25.19	0.76732	4300	1179.04	4513	884.28	0.3529	1.15522
1080	260.97	16.278	186.93	24.58	0.76964	4400	1209.42	4997	907.81	0.3262	1.16221
1090	263.48	16.838	188.75	23.98	0.77196	4500	1239.86	5521	931.39	0.3019	1.16905
1100	265.99	17.413	190.58	23.40	0.77426	4600	1270.36	6089	955.04	0.2799	1.17575
1110	268.52	18.000	192.41	22.84	0.77654	4700	1300.92	6701	978.73	0.2598	1.18232
1120	271.03	18.604	194.25	22.30	0.77880	4800	1331.51	7362	1002.48	0.2415	1.18876
1130	273.56	19.223	196.09	21.78	0.78104	4900	1362.17	8073	1026.28	0.2248	1.19508
1140	276.08	19.858	197.94	21.27	0.78326	5000	1392.87	8837	1050.12	0.2096	1.20129
1150	278.61	20.51	199.78	20.771	0.78548						

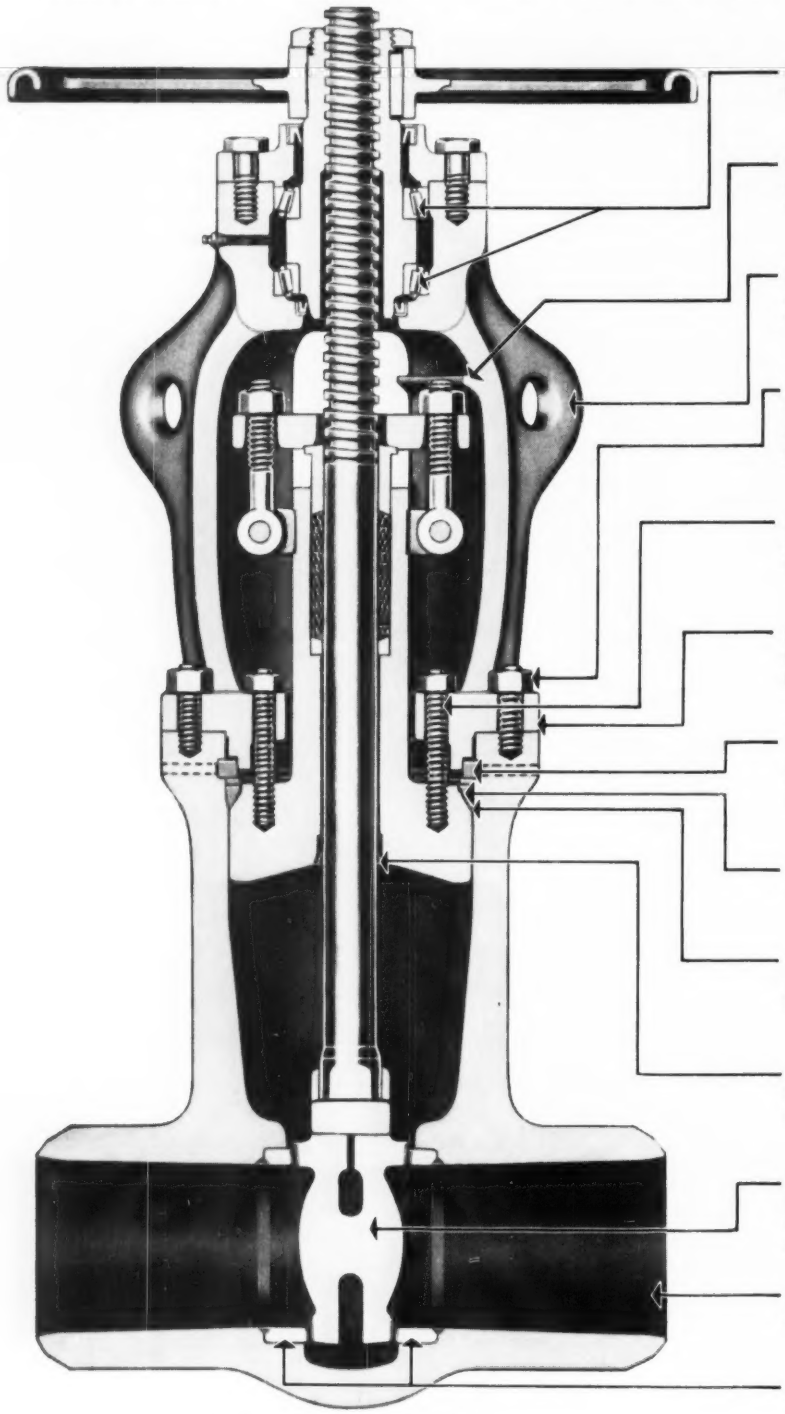
[a] Reprinted with permission from Joseph H Keenan and Joseph Kaye, Gas Tables, "Thermodynamic Properties of Air, Products of Combustion and Component Gases," Copyright 1948, John Wiley & Sons, Inc

circle 285 on Reader Service card, p 101 ➤


WHICH
STACK IS HOT?*
RIGHT: This stack is "cold" . . . inoperative. Naturally, there is no smoke.
LEFT: This stack is "hot" . . . in operation at a large Eastern utility. Smoke? There never was any! Since the station has been on the line, an efficient Koppers precipitator has been on the job.
Call Koppers—a leading manufacturer of gas cleaning equipment for industry.
*Facts available on request
KOPPERS
ELECTROSTATIC PRECIPITATORS
Engineered Products Sold with Service • Baltimore 3, Maryland

POWELL PRESSURE SEAL VALVES

GATE, GLOBE, ANGLE and CHECK PATTERNS
Pressure Classes . . . 600, 900, 1500, 2500 Pounds and Higher . . . ALL COMMERCIAL SIZES



Tapered roller bearings are most satisfactory for high thrust loads.

Lugs on the inner side of yokearms provide a convenient shelf for suspending gland flange when renewing packing.

Lifting lugs facilitate handling the valve during erection and maintenance. Also provide means for supporting weight of the valve.

Body studs hold the yokearm to the body. These eliminate the need of a heavy clamp, and maintain perfect alignment and rigidity of yoke to the body.

Bonnet studs are used to establish the initial seal of the gasket between the body and the bonnet.

Streamline contour of body simplifies application and reduces cost of insulation, and effects marked savings in space and weight.

Segmental thrust ring absorbs all the thrust applied by internal pressure. This design enables valve to be easily assembled and disassembled.

The gasket may be removed without damage to seating surface of body.

The gasket seating surface in the body may be easily lapped, if required—an outstanding feature in Powell Pressure Seal Valve design.

Stellite faced back seat and stem guide insure tight sealing, accurate guiding of stem and protects packing when valve is back seated.

Flexible "H"-type wedge, which is stellited, prevents sticking because of temperature changes and pipe line stresses, thus reducing opening torque.

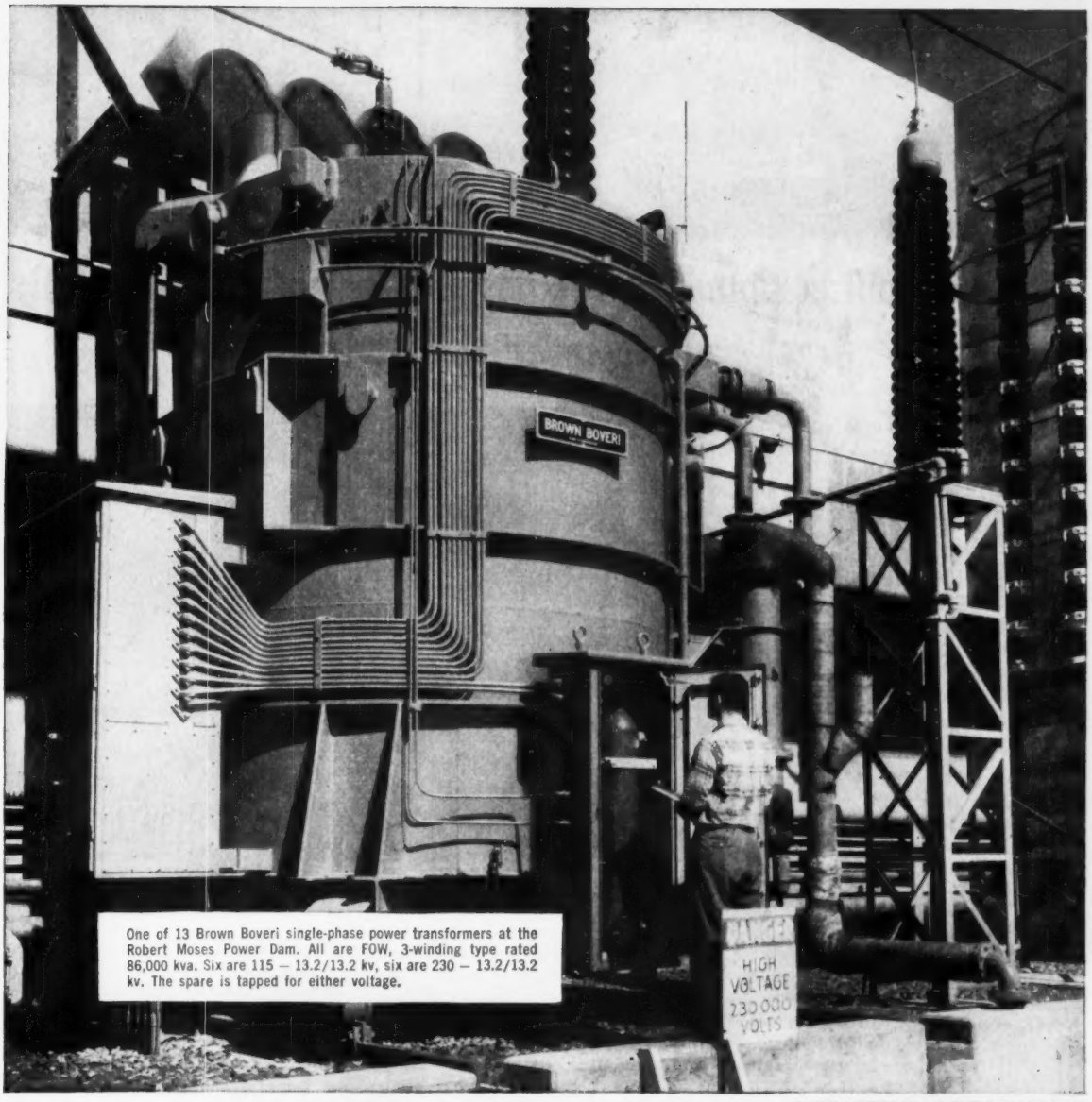
Streamlined passage makes possible maximum flow with minimum turbulence.

Seat Rings are stellite faced, accurately machined and welded in place.

(Sectional) PRESSURE SEAL GATE VALVE

THE WM. POWELL COMPANY • *Dependable Valves Since 1846* • **Cincinnati 22, Ohio**

For more facts circle 286 on Reader Service card, p 101



One of 13 Brown Boveri single-phase power transformers at the Robert Moses Power Dam. All are FOW, 3-winding type rated 86,000 kva. Six are 115 — 13.2/13.2 kv, six are 230 — 13.2/13.2 kv. The spare is tapped for either voltage.

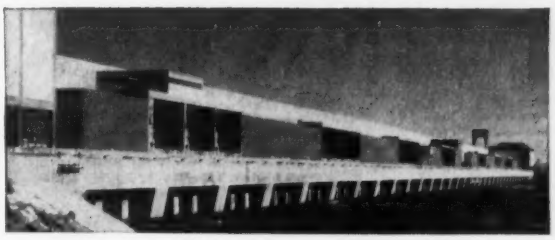
PHOTOS COURTESY OF N. Y. STATE POWER AUTHORITY

ALL'S QUIET AT MASSENA

You've heard the experts say it: Low noise means good design, tight construction. We agree. It's worth a trip to Massena just to hear the quiet around these Brown Boveri transformers.

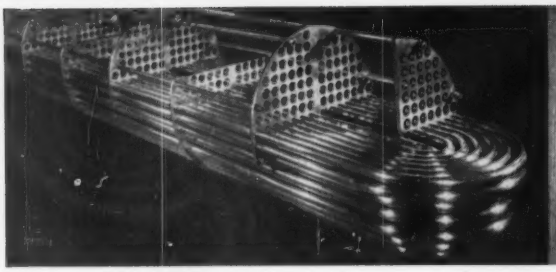
Other features that can't be heard: the compact size, the light weight per kva, the high efficiency, the reliable service facilities . . . and the substantial dollar savings for a cost-conscious power producer.

Many of these features are due to Brown Boveri's exclusive radially laminated core. We'll be glad to give you full information about this core design and other features of Brown Boveri power transformers.



The Moses-Saunders Power Dam near Massena, N. Y., second largest hydro plant in the U. S. It was constructed jointly by the Power Authority of the State of New York and The Hydro-Electric Power Commission of Ontario.

BROWN BOVERI Brown Boveri Corp., Dept. **P11,** 19 Rector Street, New York 6, N.Y. Agents in 27 U.S. cities.



CONDENSER AND HEAT EXCHANGER CLINIC

Edited by David S. Hibbard, Metallurgical Engineer
The American Brass Company, Buffalo 5, New York

New tube mill equipment gives designer of heat-transfer units freer hand in meeting new trends

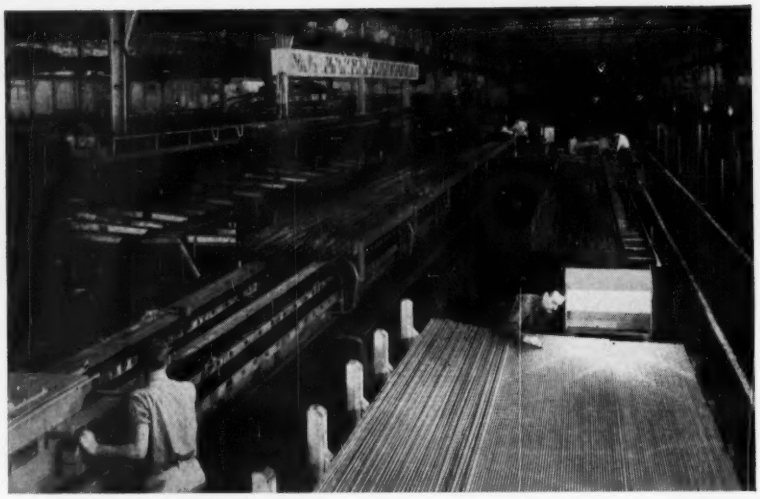
With the installation of new production and testing equipment, The American Brass Company now offers the most complete service available to users of condenser and heat exchanger tubes.

Long lengths. To gain advantages in construction, processing, or installation, designers can lengthen equipment considerably. Tubes can now be drawn up to 100 feet. Most of the longer tubes are required as U-bends, but in some instances may be shipped as straight lengths.

U-bends. Tubes from ⅜" O.D. to 1½" O.D. with wall thicknesses from .049" (18BWG) to .134" (10BWG) can be bent on a radius of from 1¼ times the tube O.D. to 30".

Dual Gage. Where high temperatures and pressures are involved, it may be desirable to thicken the tube wall in the area of short-radius bends on U-bend tubes. Walls are thickened one Stubs' Gage No. to compensate for thinning of metal in the bending.

Thickened Tube Ends. To compensate for thinning by rolling or by impingement corrosion caused by high velocities, tubes may be supplied with the wall thickened at one end one or more Stubs' Gage Nos. The extra thickness may be on the outside or inside of the tube as required.



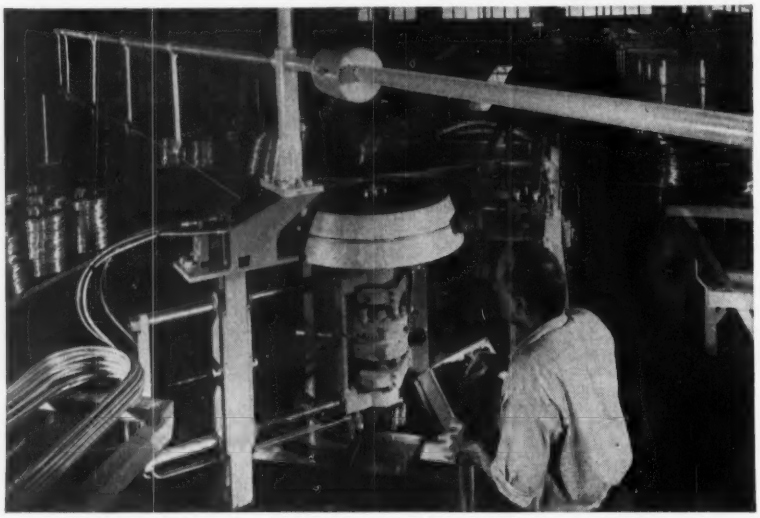
GENERAL VIEW of new American Brass Company equipment which can draw copper and copper alloy tubes in lengths up to 100 feet.

Relieving Stresses. All U-bend tubes, other than copper, are annealed at the bend area after bending, to eliminate the hazard of stress-corrosion cracking which might occur in service due to stresses that may exist as a result of the bending.

Testing. U-bends are tested hydrostatically at ASTM Specification pressures —or at ASME Code pressures up to 6000 psi on request, if the tube size will stand it. Electronic inspection with eddy-current equipment is available also, when required.

Shipping. U-bend tubes are shipped packed for ease in handling and storage.

Technical Assistance. For more detailed information on extra-long tubes, U-bend, Dual-gage, or Duplex tubes to meet special problems, address: The American Brass Company, Buffalo Division, Buffalo 5, New York. In Canada: Anaconda American Brass Limited, New Toronto, Ont. 5957 Rev.



BENDER CAN produce U-bend tubes with straight leg up to 50' long.

ANACONDA®

TUBES AND PLATES FOR CONDENSERS AND HEAT EXCHANGERS

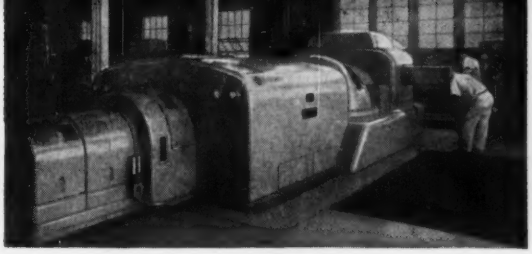
Made by
The American Brass Company

For more facts circle 288 on Reader Service card, p 101

circle 289 on Reader Service card, p 101 ➤

One reason why Fairfield, Illinois has efficient electric service—

Nonpareil Turbine Oil



Plant superintendent James Easton and Standard Oil industrial lubrication specialist Charlie Brown inspect 5,000 kw. Worthington turbine, one of four turbines in Fairfield Municipal Light & Power Company plant lubricated with NONPAREIL Turbine Oil.

These turbine installations trace the record of growth in electric power consumption in Fairfield, Illinois, over the past 19 years:

Type	Turbine Cap.	Installed
Westinghouse	1,500 kw.	March, 1940
Westinghouse	2,500 kw.	March, 1942
Westinghouse	4,000 kw.	March, 1949
Worthington	5,000 kw.	July, 1957

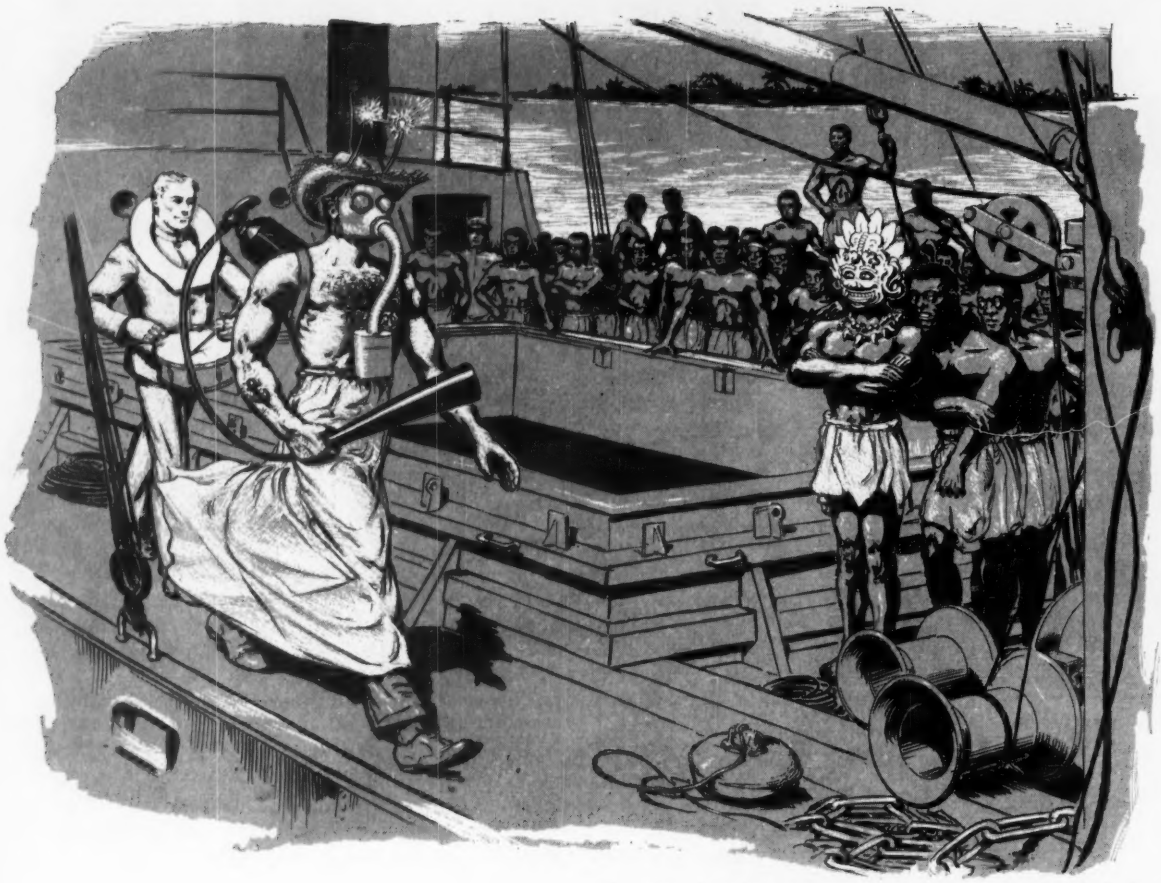
When the first turbine went into service, Fairfield Power plant management decided upon a turbine lubricant they felt would be dependable—NONPAREIL Turbine Oil. Standard Oil, they found, would give them concrete evidence of the oil's dependability. They received a certificate guaranteeing that, for the life of the turbine, the acidity of the oil would never exceed 0.15 mg. KOH/g. Indeed, through the years the oil has remained at a much lower acidity level, usually in the order of 0.06 mg. KOH/g. Periodic analysis of the oil in Standard's Whiting laboratory confirms that the oil is performing according to guarantee.

The kind of service Fairfield Municipal Light & Power gets from NONPAREIL Turbine Oil comes about this way: NONPAREIL is the subject of special refining techniques and handling. A special crude is used as a base stock. All sludge-forming compounds are removed. An oxidation inhibitor which permanently controls acidity is added. No sweetening or resting of NONPAREIL Turbine Oil is required at any time.

Men with experience in turbine lubrication can give you more facts about NONPAREIL Turbine Oil. Call your nearby Standard Oil office in any of the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

You expect more from **STANDARD** *and you get it!*

Standard's Charlie Brown, here with Easton, supervised installation of NONPAREIL Turbine Oil in Worthington turbine. His experience and training qualify him for such work. Charlie received science training and graduated from Eastern Illinois State College. He has nine years' service with Standard Oil and has completed Standard's Sales Engineering School.



"I navigated majestically out on deck in my flowing bed sheet, looking like some creature from outer space," roared Marmaduke

Bawana Ganga — Marmaduke

One of life's greatest satisfactions comes in putting a book to bed, especially after working on it for two years. And when you're talking about a library of two books—that's still better. So my coauthor J F Robinson and I had something to celebrate last week when our *Standard Plant Operator's Q & A Library* came off the press.

These two volumes are in answer to the many letters received by POWER editors asking for just such a study course. You'll read a full review of them in a later issue. I should mention that Robbie and I were shipmates in the Navy. Now he's with the N. Y. Board of Education, looks after some 40 school buildings. Besides, he teaches an evening cram course for stationary engineers. So, with the job finally done, Robbie and I headed for the Bent Propeller Bar in the right mood to celebrate.

"BILGEWATER on clobbering people on the head to get things done," we heard Marmaduke Surfaceblow roar as we barged into that hangout for seafarers. "I'll tell you low-pressure throttle pullers how I got our ship to sea after a sit-down strike and all I had to do was go native."

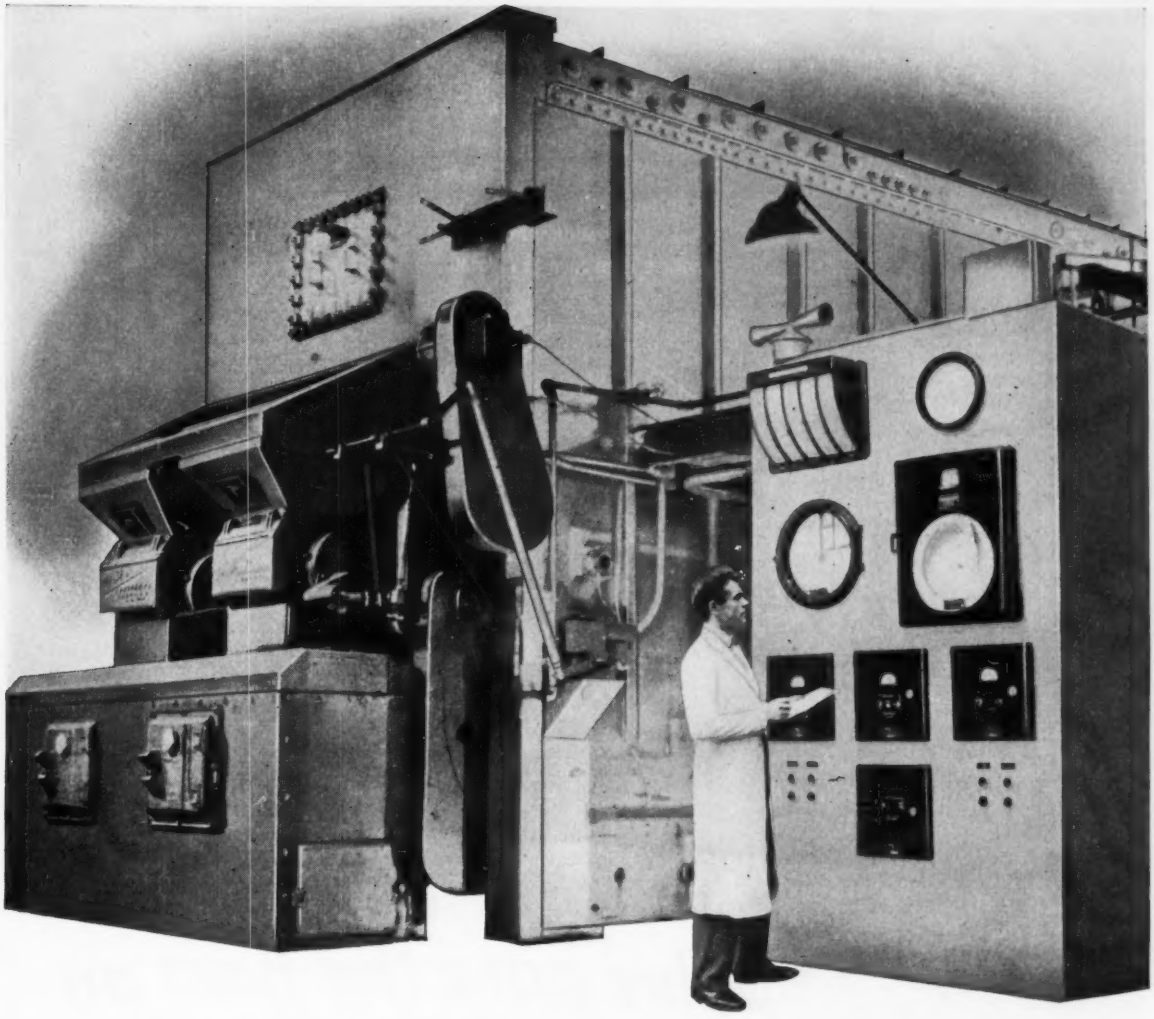
Robbie and I quickly sat down at a table. The noisy chatter stopped as all eyes turned toward Marmy, who towered above his shipmates at the crowded bar. Glaring at the sea of weather-beaten faces in the smoke-filled room, the old consultant slammed down his bottle of Sandpaper Gin, emptied his glass and blasted away in his foghorn voice.

"Back in 1934 I was chief engineer of the freighter *SS Tanganyika*. She was an old single-screw steam-turbine ship. We made a tramp run down the east coast to Mexico and Brazil, then cut across the Atlantic to pick up cargo along the west coast of Africa.

"One hot December morning we pulled into Sette-Cama, in French Equatorial Africa. That port is only a few degrees below the equator and it was hot enough to fry fish on the poop-deck plates. Our agent's radio message before arrival told us we were to load coffee, cotton, cocoa, palm oil, ivory, copper and zinc.

"To prepare for that palm oil, I had ballasted our deep tanks with sea water, then pumped them out again before arriving in Sette-Cama.

continued



Now a stoker fired steam generator with the advantages of a heat engineered "package"

The same engineering excellence that gives standard Foster Wheeler oil and gas fired steam generators their convenience, dependability and economy is built into this new, stoker-fired packaged unit.

It is designed for semi-automatic operation, comparable with the newest gas and oil fired packaged steam generators. The push of a button can bring it on or off a banked fire. The firing front can be converted for oil firing over a weekend. Shipment in three major subassemblies materially reduces the amount of labor as compared to field erection of coal burning steam generators of similar capacity.

In brief, this new packaged steam generator is everything you would expect from the company that originated the "steam package concept". In a series of exhaustive tests, the new unit has exceeded all expectations for capacity and efficiency.

If you are in an area where coal would be your most economical fuel, you will find it well worth your while to get full information on Foster Wheeler's new stoker fired packaged steam generator before writing specifications for any new steam generating installation. It is available in three standard sizes: 43,000 lb, 50,000 lb and 63,000 lb of steam per hour at 250 psi. Or, if an oil or gas fired unit would be more suitable, get specifications on Foster Wheeler's full line of packaged steam generators in capacities from 13,000 lb/hr to 100,000 lb/hr.

Heat Engineered products, plants and processes . . . for the world's industrial progress.

Write to: Foster Wheeler Corporation, 666 Fifth Ave., New York 19, N. Y.

FOSTER WHEELER

NEW YORK LONDON PARIS ST. CATHARINES, ONT.

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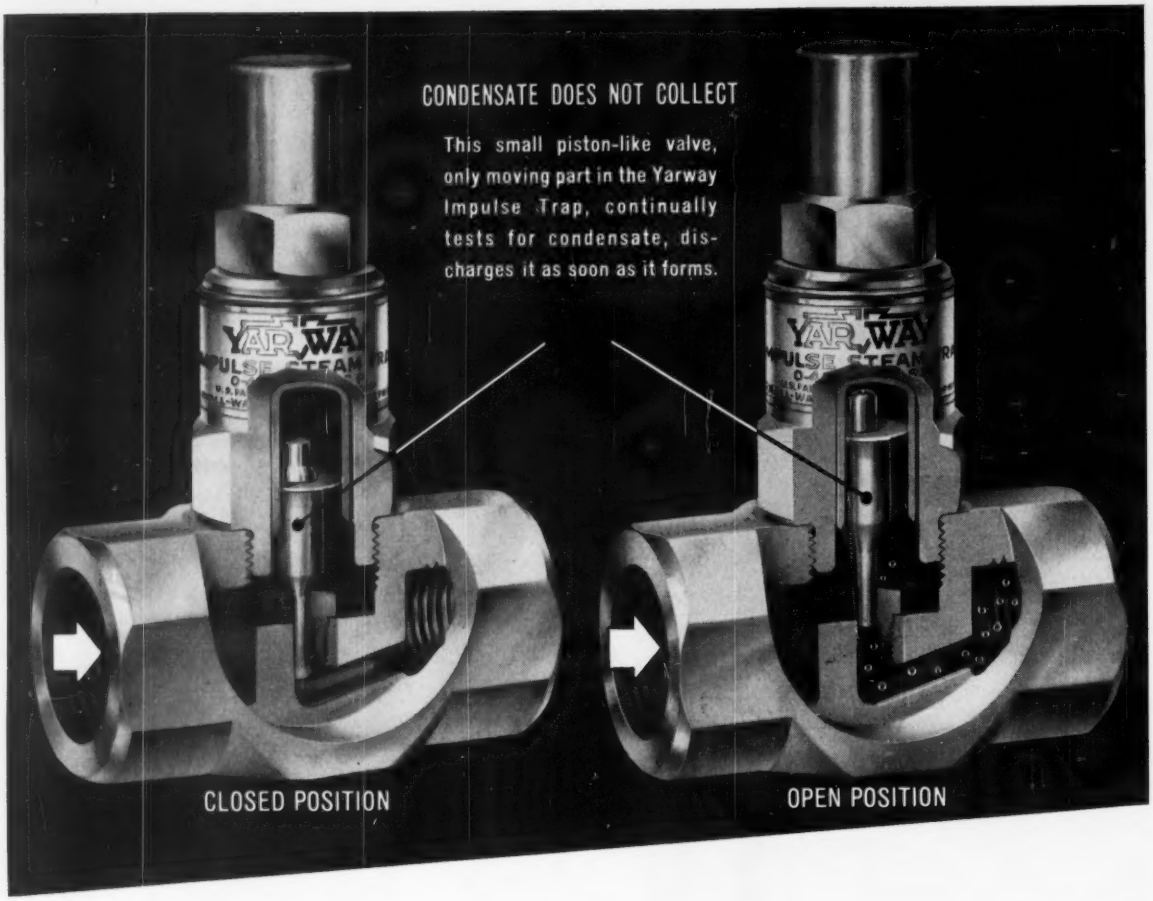

CONDENSATE DOES NOT COLLECT
This small piston-like valve, only moving part in the Yarway Impulse Trap, continually tests for condensate, discharges it as soon as it forms.
CLOSED POSITION
OPEN POSITION

Yarway Impulse puts the heat on steam trap freeze-up problems

Cold weather means nothing to a Yarway Impulse Steam Trap. *Its design offers full protection against freeze-ups,* with resulting costly production delays and extra maintenance work.

In the Yarway Impulse Trap there's nothing to freeze. No condensate collects. The only moving part (a tiny piston-like valve) continually tests for condensate and discharges it as soon as it forms. Result—continual operation of steam equipment at high, even temperatures.

Consider this non-freeze feature with these other Yarway Impulse features:

- **Quick heat-up**
- **Low maintenance**
- **Stainless steel construction**
- **Small size—light weight**
- **Good for all pressures**
- **Complete line for all requirements**

—and you have the reasons for nearly 1,300,000 successful installations.

Stocked and sold by 270 Industrial Distributors, coast-to-coast and around the world.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY
A MARK OF QUALITY IN STEAM ENGINEERING

Marmaduke

Continued from page 140

The deeps carry a ship's Bunker-C fuel oil, but they are also used for either dry or liquid cargo when empty. Our deeps ran thwartships in No. 3 hold. Both port and starboard deep had large flat gasketed steel covers. Each tank could hold about 26,000 gallons of oil.

"Palm oil was expensive cargo so those tanks had to be cleaned thoroughly. That meant hiring natives to go into them after our deck winches lifted the large covers. They would have to kerosene and wipe every square inch of surface clean of fuel oil. After that the tanks would have to be sprayed with a caustic-soda solution, then rinsed with hot water again before loading.

"Our agent Roberti Qualis had sixty barefooted natives standing by on a barge soon as we dropped anchor that morning. The barge was towed alongside and the blacks climbed aboard. The deeps were opened and our carpenter got busy rigging scaffolding inside the tanks. Several drums of kerosene and bales of rags were lowered inside for the cleaning gang.

"I had just sat down to noon chow when I heard a commotion up forward. Barging out on deck I saw the natives scrambling wildly out of No. 3 hold, yelling as if a demon was after them.

"After a lot of blabbing between the No. 1 boy and our mate, I learned that one of the blacks suddenly got frightened in the hold. He came screaming up on deck, yelling that the hold was bewitched. That panicked the others. They milled around on deck, jabbering at the No. 1 boy to have them taken shoreside.

"Our agent arrived on the launch about then. He tried to calm the blacks. But they wouldn't listen to him. We had to pick up that palm oil because it was the best paying cargo along the coast. Besides, our line needed the business. But each hour in port cost money, so the agent tried to persuade the blacks to go below. He finally got sore, started shaking his fist and cursing at them. The blacks dove over the side, one after the other, and swam ashore.

"Next morning Qualis was aboard again, in a nasty mood. Said he had solved the mystery. Just as he thought, there was dirty work afoot. His archenemy, Sal Jerigo, the half-breed Swahili agent for a Dutch line, had planted one of his blacks in that gang to cause the panic. Jerigo wanted the palm oil for one of his ships coming in a week later.

"There we were, anchored out in the harbor for two blistering days. By then most of us were going nuts with the heat. All we wanted to do was shove off and get as far from the equator as we could.

" 'I'd give a hundred dollars to anyone who'll take that sneaky Jerigo into the jungle and cut his filthy throat,' remarked our agent half seriously during lunch with us the second day. 'He gives me some kind of trouble every time I book cargo for a ship.'

"The skipper's only comment was that we'd have to leave Sette-Cama by next morning if that palm oil wasn't loaded. But Qualis' remark was going around and around in my noggin, giving me a brainstorm.

" 'Will you fork over a hundred bucks to me if I get those natives into the tanks?', I asked.

"Everyone stopped eating and stared at me to see if I was kidding.

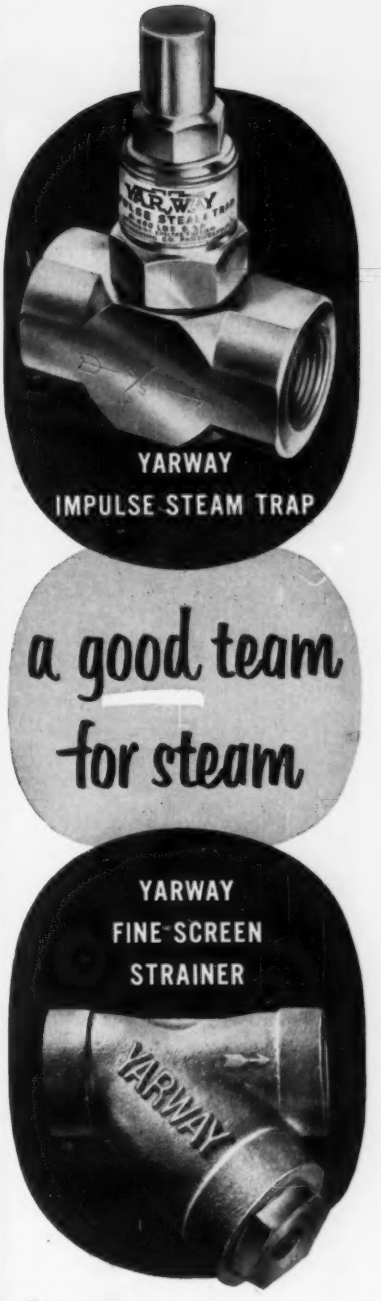
" 'Why yes, sure I will,' finally said Qualis. 'I don't care how you do it, long as we don't lose that cargo to Jerigo and tie up the ship any longer.'

" 'OK,' I answered. 'You get those natives back aboard. I'll get them into the deeps.'

" 'Ha, ha, ha,' he roared sarcastically, getting pink around the gills, 'and just how do you expect me to do that? They seemed in a big hurry to leave.'

" 'That's easy,' I answered. 'Your No. 1 boy can tell them that a spook was found in the hold, just as they claimed. Ask them to show up with their witch doctor. Explain that the ship's white witch doctor will kill that devil while they watch!'

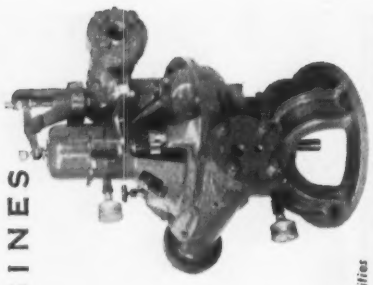
" 'I think the Chief's got something,' said the skipper, perking up his ears. 'Hell, we can't lose anything. And if Mr Surfaceblow succeeds, it'll be worth a lot more than the one hundred dollars.' continued

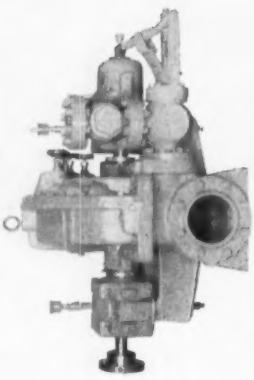


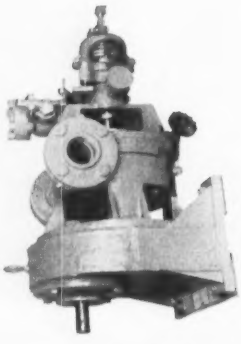
This Yarway team has scored high—1,300,000 installed on all types of steam equipment. Stocked and sold by 270 Industrial Distributors. For free Steam Trap Book, write YARNALL-WARING CO., 100 Mermaid Ave., Phila. 18, Pa.

YARWAY
A MARK OF QUALITY IN STEAM ENGINEERING

circle 292 on Reader Service card, p 101







FOR 40 YEARS . . . THE QUALITY NAME IN TURBINES

CARLING TURBINE BLOWER CO. 7 NEBRASKA ST. WORCESTER, MASS. *Representatives in Principal cities*

WRITE FOR BULLETIN 20-C-3

CARLING TURBINES

Marmaduke

Continued from page 143

"'That's a deal,' said the agent, getting the point. 'I'll get those fuzzy-wuzzies aboard—and tonight.'

"By ten that night most of the blacks were aboard with their witch doctor. You'd think they were going to a circus. They were jabbering a mile a minute as they waited for the show to begin. And I was ready for them.

"We had inflated a few dozen party balloons that our good-natured steward had for decorating the mess rooms on New Year's Eve. They were tied into a cluster inside a white sheet and placed in No. 3 hold. I also had a bottle of catsup down there.

"As zero hour neared I was in my office, getting ready. I wore a big peon's straw hat I had picked up in Mexico. Inside were two dry-cell batteries feeding two copper-wire antennas that came out of my hat like the feelers of a giant insect. On the antenna ends were tiny flashlight bulbs. They were flashed on and off by thermal flashers screwed into their sockets. Only clothing I wore was shoes and a bed sheet wrapped around my khaki pants. I threw a carbon-dioxide fire extinguisher over my shoulder and had the captain's revolver and a flashlight in my hip pockets under the sheet. For good measure I wore a gas mask. The third mate was an amateur musician so I had him standing by with his trap drum. In contrast, he looked very dignified in his white uniform.

"It was shortly aften ten and a dark cloudy night. Only one cargo light was on, that up over No. 1 hold. So No. 3 hold was dark. The stage was set—the show ready to begin.

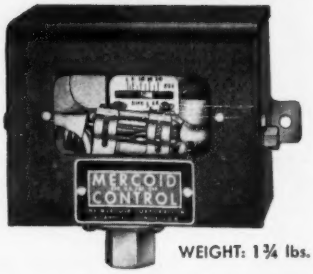
"The captain gave the ship's whistle a short blast. That was the signal. The third mate and I started out of my office for the forward deck. As we passed the first mate's room, he stepped unexpectedly out in front of the third mate, yanked off his high-pressure cap and slid a new toilet seat over the surprised Third's head. We busted out laughing but the third mate didn't mind and wore it as a collar. Outside on deck he stood at attention alongside the door;

NEW

Small, Lightweight

MERCOID PRESSURE CONTROL

AP-153

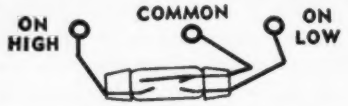


WEIGHT: 1¾ lbs.

FOR MEDIUMS NOT INJURIOUS TO STEEL OR SILVER SOLDER

CIRCUIT

SP-DT HERMETICALLY SEALED MERCURY SWITCH (4A. 115V., 2A. 230V.)



Provides any of following operations:

1. *Single Pole—Cut-in high (close on rise)*
2. *Single Pole—Cut-in low (open on rise)*
3. *Single Pole—Double Throw*

OPERATING RANGE

ADJUSTABLE OPERATING RANGE	SWITCH DIFFERENTIAL PSIG. With Pointer Set At LOW	HIGH
1 to 20 psig.	0.3	0.5

CONSTRUCTION

ADJUSTMENT: External
PRESSURE ELEMENT: Fairprene diaphragm
PRESSURE CONNECTION: ¼" I.P.S.
MOUNTING: Has two mounting ears (one on each side of control) or control may be pipe mounted by means of the ¼" I.P.S. bottom connection.
INTERNAL WIRING CONNECTIONS: 3 post terminal block.
CASE: NEMA 1—Heavy gauge steel, cadmium plated. Steel cover (with glass front) finished in charcoal-gray.

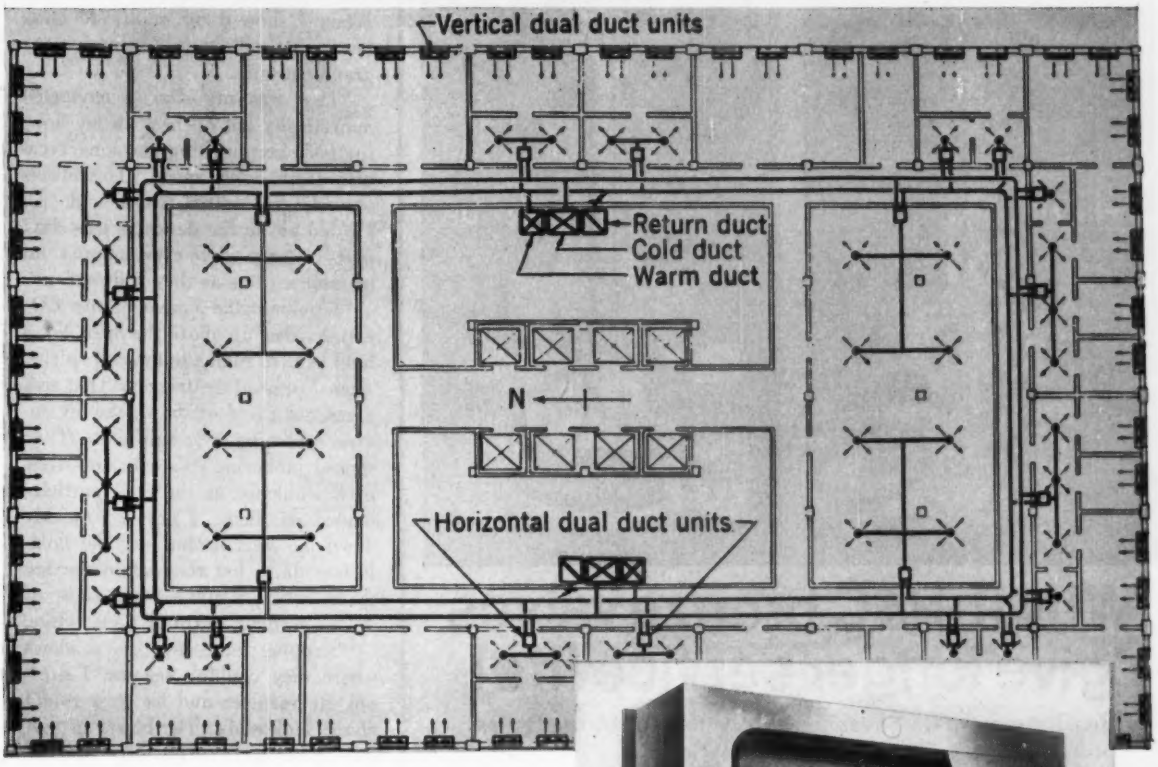
WRITE FOR BULLETIN 02

THE MERCOID CORPORATION
4201 Belmont Ave., Chicago 41, Ill.

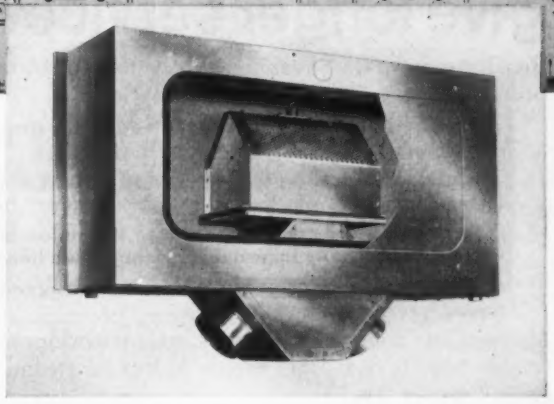
circle 293 on Reader Service card, p 101

circle 294 on Reader Service card, p 101

HOW TO "BALANCE A BUILDING" BEFORE IT'S BUILT:



Shown above is a typical office building dual duct layout, 100 per cent air system. It is zoned to provide selective temperature control for each enclosure with Buensod vertical dual duct units at exterior walls. These under-window units may be connected to vertical risers, or to horizontal mains at the ceiling or on the floor below.



Illustrated: Buensod Type V window-wall unit with cut-away showing automatic volume control. This unit is designed for installation under windows to discharge vertically upward, quietly and without draft.

Balancing a building before it's built . . . almost an incongruity, yet Buensod does it consistently. Buensod air mixing units can be pre-set at the factory for desired volume and guaranteed within ±5% when installed. Whenever desired, a change in air volume may be made in the field by simple adjustment of one nut. This practically eliminates the tedious job of balancing after installation . . . a chore which can take months.

The secret is in Buensod's proven Automatic Volume Control. A simple tent-like apparatus maintains constant air quantity from each unit regardless of variance of static pressures on either inlet or outlet of mixing valve. This operates automatically . . . independent of any outside power source, sensing instrument or complicated linkage arrangement. The mixing valve is actuated by a local thermostat to provide the desired room temperature.

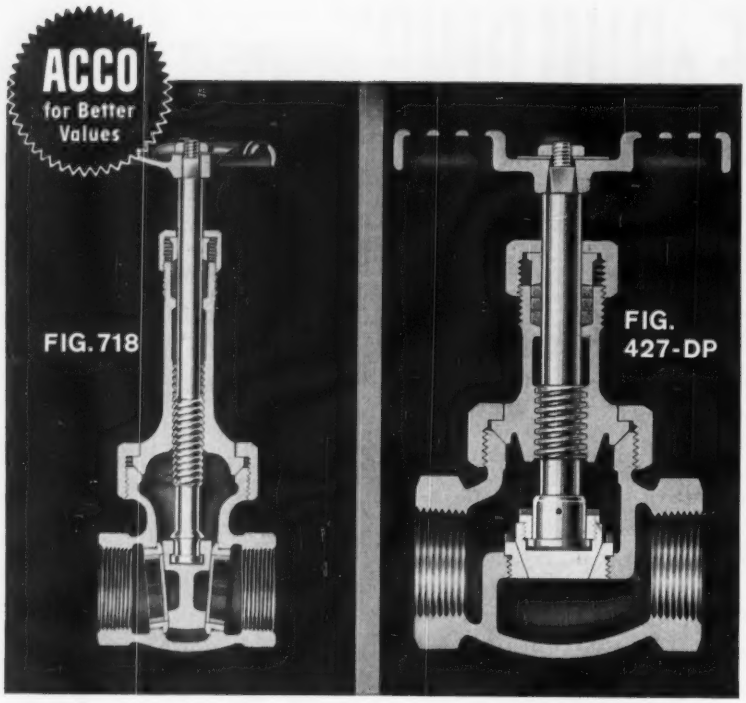
Buensod units are being designed into a constantly increasing number of new and renovated structures. Consider them for your next project.

BUENSOD DUAL-DUCT

Write for details to: BUENSOD-STACEY

Buensod-Stacey, Inc., 45 West 18 Street, New York 11, New York

For more facts circle 295 on Reader Service card, p 101



Why R-P&C bronze valves give longer service life!

Here are some of the advantages you get when you use R-P&C Bronze Valves—either globe or gate style:

1. **Renewable seat rings, screwed in for greatest convenience**
2. **Higher resistance to galling and pitting, because stems are made from special rolled "Coradur" bronze**
3. **Easier maintenance, thanks to the union bonnet which permits easy internal servicing when needed**
4. **Added ease of operation, due to the rugged, air-cooled, cross-type handle**

All these, and many other features, add up to a longer and more trouble-free life of R-P&C Bronze Valves for steam, water, oil and/or gas service.

Shown above are two examples from the R-P&C line of Bronze Valves: Fig. 718 (gate) and Fig. 427-DP, a full-plug globe valve. Your R-P&C distributor can furnish complete information on the entire R-P&C line of valves, not only in bronze, but in electric furnace iron, cast steel, bar stock and forged steel. See him—or write us direct for catalog.

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"How to Protect Your Valves"

Installation pointers, operating tips, clues to longer valve life. They all are on the 22" x 17" wall chart. Write us at Reading, Pa., for your free copy.

R-P&C VALVES

ACCO

R-P&C Valve Division, American Chain & Cable Company, Inc.

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

Marmaduke

Continued from page 144

When I showed up in the doorway he started rolling his drum for my grand entrance.

"That was my cue. I navigated majestically out on deck in my flowing bed sheet, looking like some creature from outer space. The blacks were ringed around No. 3 hold. All I could see in the darkness was sixty pairs of large white eyes popping out of their sockets as they followed me.

"I pointed the nozzle of my CO_2 extinguisher up above the open No. 3 hold as if to fumigate the evil spirits. Then I pressed the trigger. That sent a gaseous cloud of snow over my audience, turning their hair white. They started jabbering excitedly and drew back suddenly as the cold particles landed on them. I crawled quickly down the steel ladder into the hold. It was dark, but they could see my white robe. I sprayed the sides of the deep tank, turning them white.

"Stepping back into the shadows where they couldn't see me, I drew out my revolver and let go a round at the bulkheads. The blasts in that steel hold were deafening. At the same instant I squirted the bottle of catsup all over myself. Then I let out a groan and grabbed the sheetful of balloons.

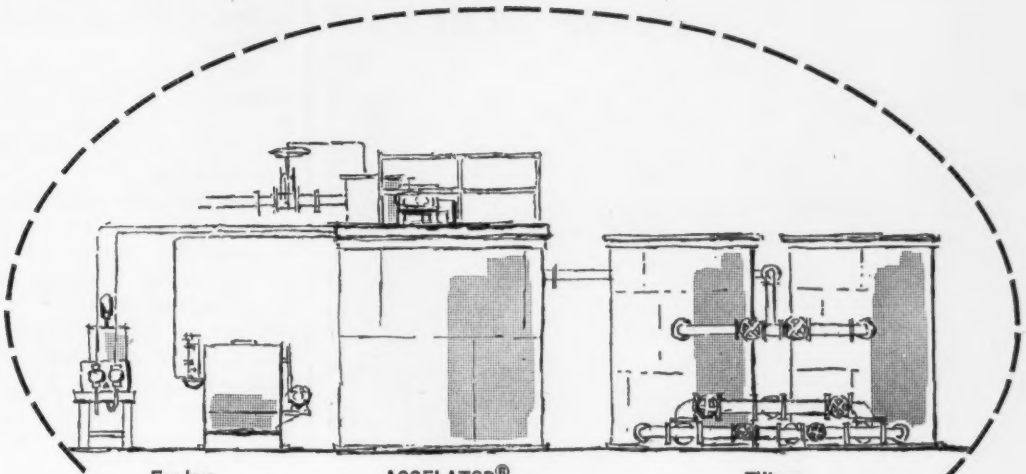
"Yelling as if being murdered, I ran out of the shadows under the open hatch, struggling heroically with the floating demon. Gliding it against the deep tank's side I started slamming away with my fists. Balloons inside the sheet popped with each bone-crushing jab. The large billowy monster gradually vanished, turning into an empty piece of rag as the natives' eyes bulged even further from their sockets.

"After that herculean struggle I staggered crazily and made for the ladderway. Finally I was on deck. As the third mate started rolling his drum again, I heaved the bloody, dripping lump of bed sheet that was clutched in my fist into the drink.

"To make sure I had the local witch doctor on my side and to give him prestige with his boys by bringing him into my act, I drew my high-powered flashlight and threw a blinding beam into his eyes. Then I bowed very slowly in his direction

For more facts circle 296 on Reader Service card, p 101

A complete "package" water treating plant...



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COMPLETE—from inlet to outlet—nothing else required.

ADAPTABLE—for clarification, softening, iron or color removal, and sterilization. Pressure or gravity filters, as required.

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SIMPLE—working parts, easily accessible for minimum required attention. Simple erecting and operating instructions.

DEPENDABLE—treatment results are easily obtained; uniformly and dependably maintained.

ECONOMICAL—costs of plants are low due to quantity purchasing and production; installation space is small; maximum utilization of treating chemicals is assured.

9401

Write today for full details on the "ACCELAPAK" plant in Bulletin 1870-A or request Bulletin 80 showing our complete line of water and waste treating equipment.

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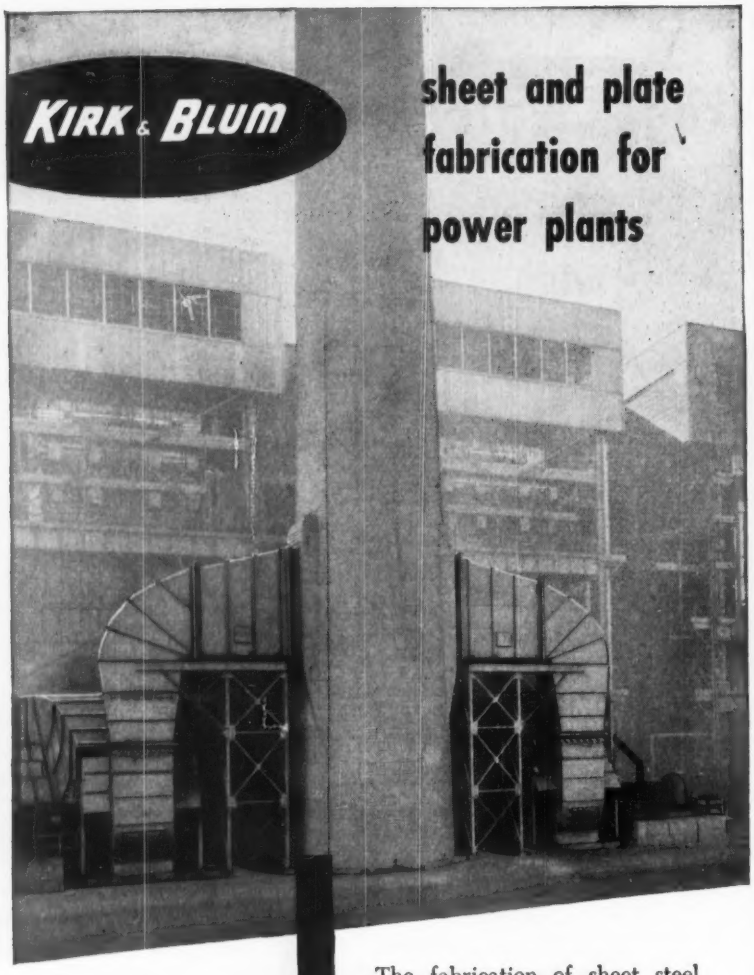

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Whatever your requirements in sheet and plate fabrication . . . call on KIRK & BLUM.

THE KIRK & BLUM MFG. CO.
3233 Forrer Street, Cincinnati 9, Ohio

Marmaduke

Continued from page 146

twice, and roared, 'Bawana Ganga, I hope the St. Looie Cards win the pennant this year because the Brooklyn Dodgers are a lot of beer-drinking bums.'

"The drum stopped rolling and I stepped over the door coming into the engineer's alleyway. The ship's whistle gave another blast and the show was over.

"That broke the spell. The native witch doctor came to life with a blood-curdling shriek and started gyrating wildly, evidently screaming instructions at his buddies. They jabbered wildly and climbed down into the hold as quickly as they could. The mate turned the large cargo lights on over No. 3 hold as the blacks started in where they had left off two days before.

" 'Swell job!' said Qualis, shaking my hand and patting me on the back soon as I returned to my office. All the ship's officers joined in the hand-shaking. Qualis invited the Third, skipper and myself ashore to Brazzaville, the capital. We had a rip-roaring time and didn't return until the ship was ready to sail two days later. By then 52,000 gallons of palm oil were safely in our deeps.

"From that time on I was known as Bawana Ganga, or Mr Witch Doctor, all up and down the coast. I kind of liked the title. After all, I had earned it." —STEVE ELONKA

Marmy's Mailbox

'Tis here you exchange blasts with the old boy

BIG TIME FOR MARMY

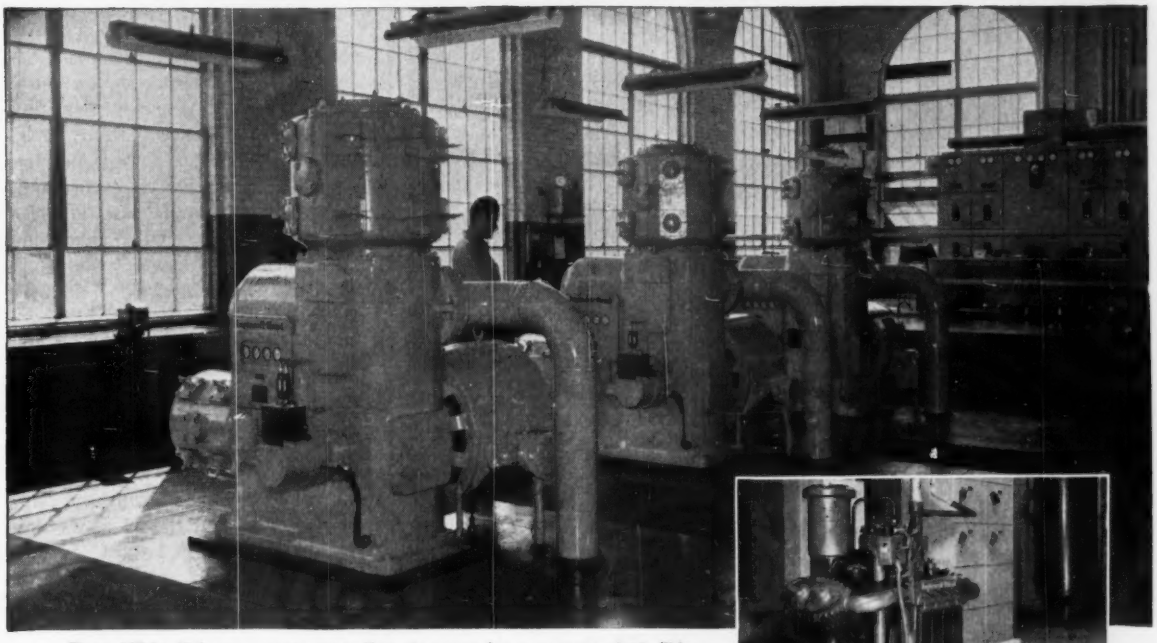
I'll keep rooting for Marmy until I see him in the big time—*Saturday Evening Post*, TV, radio—where an outstanding character like that ingenious operator belongs. Too, I think a complete collection of his 140 stories should replace the present booklet of 21 stories.

S H POST, *New York, N. Y.*

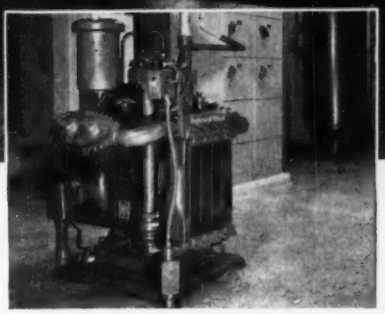
continued

For more facts circle 298 on Reader Service card, p 101

How to squeeze more profits out of your COMPRESSED AIR POWER



Three 125-hp XLE compressors generating air power for a weapons plant. This compact two-stage unit features pipeless Thru-Frame air flow and full-floating aluminum bearings which never need adjustment. Sizes 125 to 350 hp. (Other I-R air compressors to 4000 hp.)



This air-cooled two-stage Type 40 compressor is one of several furnishing plant air and instrument air in a power plant. Sizes 25 to 125 hp. (Others from ½ hp.)

Make sure you have enough pressure at point of use—and extra dependability at point of generation

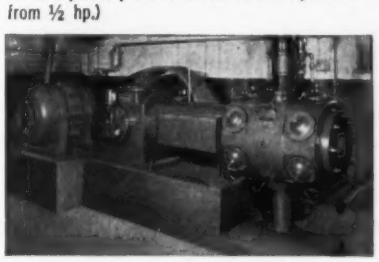
Cost-conscious plant engineers and production men know that to get the full savings inherent with air-powered equipment, you must have full air pressure at every tool.

But it's equally important to guard against unscheduled shutdowns where your air power is generated. This problem can best be solved at the time of purchase, by specifying compressors that have an extra margin of safety against mechanical troubles.

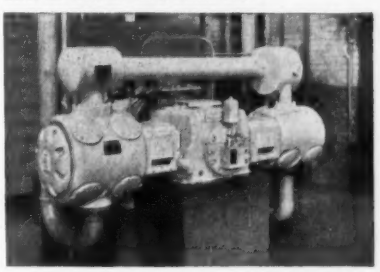
Ingersoll-Rand compressors have that extra safety margin built in. They'll stay on the job longer, with minimum attention and maintenance. Take valves, for example—the most "vulnerable" point in any compressor. Only I-R compressors have Channel Valves, known the world over for efficiency, quiet operation and long life. Their exclusive air-cushioned action eliminates impact and greatly reduces wear.

Also in I-R compressors, all running parts are sealed against dust and dirt which might cause wear. The seal need never be broken, since bearings are a type which will never need adjustment.

For top compressor performance and long-run economy, specify Ingersoll-Rand. And ask your I-R representative to show you how to get your maximum *"Dividend on Payroll Dollars"* with a Planned Annual Review of your air power system.



Ingersoll-Rand's new ESH horizontal compressor, here in a tool factory. Sizes 20 to 150 hp. Also built as vertical unit, called ESV.



Two-stage balanced-opposed PHE compressor handling air in a gas plant. Also built as L-design unit with packaged intercooler. Sizes 75 and 100 hp.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

For more facts circle 299 on Reader Service card, p 101

FOR ⅛ TO 1½ INCH BRANCH CONNECTIONS

MARK

CUT

WELD

NEW W-S TeeLet SLASHES TEE COSTS 50% OR MORE!

The new W-S TeeLet replaces conventional Tees of cast or malleable iron, welded or forged steel . . . requires fewer stock sizes. Available in sizes from ⅛ to 1½" IPS, TeeLets are fully machined from forging quality solid steel bars and adapt to run-pipe sizes to 36". They require no additional joint strength calculations for any ASTM A-53 or A-106 Grade B run-pipe of Schedule 40 or 80.

What about cost? A size-by-size comparison with conventional Tees shows TeeLets average less than 50 per cent of the cost you now pay. A W-S TeeLet, with screwed, socket-weld or butt-weld ends, requires no shaping, fitting, beveling or extra alignment. You can connect to the run-pipe at any point. Short heights mean easy inspection of the attachment weld or back-weld, if desired.

A W-S TeeLet costs less to buy, less to install than anything you can buy or make. For complete information, prices, and names of distributors, write: *Forge and Fittings Division, H. K. Porter Company, Inc., Box 95, Roselle, N. J.*

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Marmaduke

Continued from page 148

HAS MARMY'S BACKGROUND

I always read Marmy's story first when POWER arrives. His unusual experiences with their common sense solutions are certainly true to life. Like Marmy's background, my interest in machinery started on my father's farm. We had threshing equipment, grist mills, saw mill rigs and oil-well drilling rigs. That's one reason I enjoyed the story about the threshing engine in his "Haywire Engineering."

LT CMDR R E MILLER, *USN*, *New York, N. Y.*

SENDS REGARDS

Please give my best regards to Mr Surfaceblow next time you drop into the Bent Propeller Bar. I sure enjoy his stories although I must say that he was pretty hard on the machinery in his August '58 yarn.

N M NIELSEN, *Porto Alegre, Brazil*

MARMY FOR XMAS

Received the Marmy book for Xmas, and read the whole darn book the first night. Marmy has more psi than any guy I've seen or listened to since I left the service.

C R SAMPLE, *Milwaukee, Wis.*

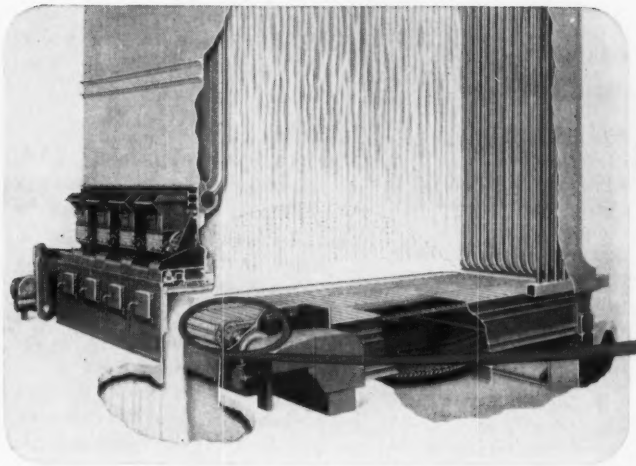
FROZEN BILGEWATER

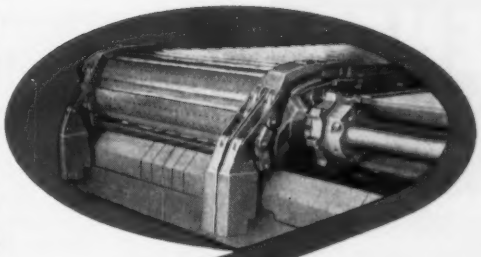
"Marmy's hydraulic jack," April 1958, reminds me of the time Colin Glencannon paddled ashore in a frozen side of cow from a refrigeration ship. But this business of lowering a heavy diesel engine on blocks of ice won't work. The engine would topple over because the ice would first melt around the outside.

J M GORRIE, *Akron, Ohio*

EDITOR'S NOTE: *Not if the ice blocks were staggered, with openings at ends so melting could be controlled by spraying comparatively warm water at parts melting slowly. This lowering machinery with ice is an ancient trick. Wouldn't be surprised if many of our readers had used it. If so, let's hear from you.*

continued





Long grate bars with closely fitting overlay joints prevent leakages. Venturi air openings are spaced to provide uniform air distribution.

GRATES ARE THE GUTS OF A STOKER

DETROIT ROTOGRATE HAS PLENTY OF INTESTINAL FORTITUDE

No matter what else it has, no stoker can be a complete success without trouble free efficient grates.

The Detroit RotoGrate Stoker has other outstanding features in abundance but without the superior grate design it could never have achieved such instant and lasting success.

The advent of the RotoGrate Stoker established a whole new trend in coal firing and stimulated many competitors but none has seriously challenged the superior performance and long life of the RotoGrate.

Our grates are high resistance metering type with venturi air openings spaced to provide uniform air distribution. Long grate bars have close fitting overlay joints to prevent leakages that cause blow holes and burnouts.

Sturdy construction and use of special alloy iron makes these grates long lasting under the most exacting service.

Guide chains riding over toothed sprockets assure positive grate bar alignment. A unique method of attachment avoids chain wear and stretching, while the catenary take up of slack prevents jamming.

Forward travel continuously discharges ash. Automatic combustion control varies the speed of travel in step with fuel feed rate to maintain uniform fuel bed while following fluctuations in load.

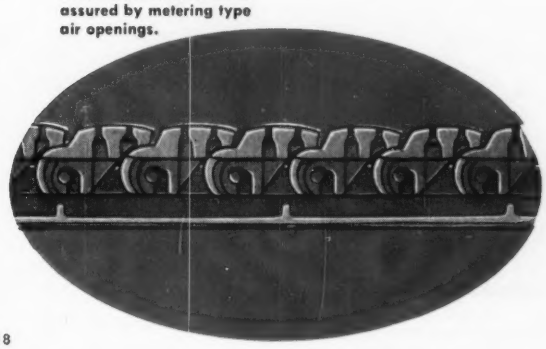
Burns all grades of bituminous and lignite coals, also many kinds of refuse and by-product wastes.

The RotoGrate for boilers to 400,000 pounds steam per hour capacity; other Detroit Stokers for capacities from 3,000 pounds steam per hour.

DETROIT STOKERS COST LESS

Cost equals initial investment plus upkeep plus production losses due to equipment outage. The total is less with Detroit.

Even distribution of air is assured by metering type air openings.



DETROIT SINCE 1898 STOKERS

DETROIT STOKER COMPANY

MAIN OFFICE AND WORKS • MONROE, MICHIGAN

8418

District Offices or Representatives in Principal Cities

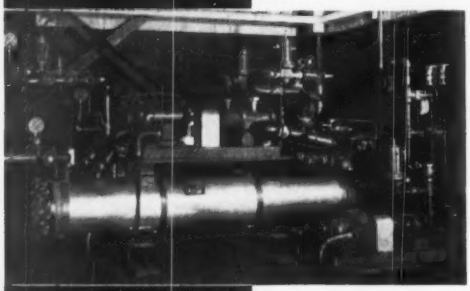
For more facts circle 301 on Reader Service card, p 101

ENCO

Fuel Oil Pumping and Heating Systems

For heavy bunker oil or light furnace oil...100 to 10,000 gallons per hour

Enco systems employ one, two or more pumps and heaters, interconnected so that full capacity is possible with any combination of pumps and heaters. Flexibility of design permits the use of any combination of rotary pumps, with motor or turbine drive; or piston type steam pumps. Any part may be cut out of operation for inspection or cleaning, without shutting down, where two or more pumps and heaters are included in the unit system.



Heaters are insulated and jacketed with removable heads at both ends for cleaning without breaking any piping connections or removing any tube bundles.

Full automatic oil pressure and temperature control, with relief valves for each pump and heater. Permits delivery of oil with safety, and at proper temperature and pressure for efficient burning.

Each unit is built to order and delivered ready to place on foundation and for connection to the station piping.

Write for Bulletin OB-53 describing Enco Gas and Oil Burners; and Pumping and Heating Equipment.

THE ENGINEER COMPANY
75 WEST STREET
NEW YORK 6, N. Y.

EC 808

For more facts circle 302 on Reader Service card, p 101

Replacement Tubes

BOILER TUBE COMPANY OF AMERICA

McKEES ROCKS, PA. (Pittsburgh District) Federal 1-7750

Marmaduke

Continued from page 150

HAS BETTER IDEA

"Marmy's space ship," July 1958, was an ingenious way of getting a line to the top of the stack. But he could also have used a light umbrella. If passed in through the cleanout door, then opened, it would carry a light line up the stack. I'm assuming that the main damper was in the uptake flue and not in the stack.

After leaving the stack, the umbrella would float down to earth without need for shotguns. Both methods require strong updraft.

A F SHEEHAN, *Springfield, Mass.*

SIMPLE SOLUTION

Marmaduke sure does things the easy way. His solutions always fascinate me; they're practical and sensible, therefore simple. My reaction always is: "Why didn't I do it that way?" More power to him.

E A ROBERTS, *Carlsbad, N. M.*

TIME TO READ MARMY

We enjoy POWER very much and have recommended its subscription in numerous instruction manuals prepared for clients or their customers. Too, we always manage time to read Marmy's latest story.

C A KERSHAW, *Portland, Ore.*

PROSPEROUS MARMY

That guy Marmaduke really runs the gamut, from melting ice platforms to shooting balloons out of the sky. Hurray for the best of today's old-time engineers. I wonder if Marmy would tell us his biggest boner—it must have been a ripper. Marmaduke will always prosper.

C G HOWARTER, *Canton, Ill.*

EDITOR'S NOTE: *Marmy did let down his hair once, when he told about his greatest sorrow ("Marmy's big bust," Feb '58, p 146.) We asked the old consultant whether that was his biggest boner, and he replied with a voice of thunder.* "BILGEWATER," *he cried, "that wasn't a boner. That was one of life's tragedies—it doesn't bear talking about." With that, he turned to a new bottle of Sandpaper Gin, and we tiptoed back to the office.*

For more facts circle 303 on Reader Service card, p 101

Compact and completely pre-assembled, Inland Empire Paper Company's Package Air Preheater is ready to be connected to a 100,000 lb/hr boiler. This particular Package Air Preheater (incidentally a repeat order), measures approximately 10'x10'x8', and its 7000 square feet of effective heating surface will recover about 360° F. from the stack gas. Package design cuts installation time and costs drastically.

Here's why
Inland Empire Paper Co.
chose a

PACKAGE AIR PREHEATER

BIG INSTALLATION SAVINGS — AND FUEL SAVINGS THAT CAN PAY FOR THE AIR PREHEATER WITHIN TWO YEARS.

Inland Empire Paper Company, Millwood, Wash., makes these big savings with their Package Air Preheater:

1. Low-cost installation. That single unit on the truck is a *complete* Package Air Preheater. Once in place, and the ducts and power line hooked up, it will be ready to go—installed without erection in a fraction of the time required for conventional units.

2. Short-term write-off. Records of Package Air Preheaters operating all over the country prove that Inland Empire's Package unit can pay for itself in two years, just on fuel savings alone!

You get this double advantage with the Package Air Preheater because it's completely shop-assembled. And its compact design brings all the advantages of continuous regenerative heat recovery to boilers as small as 25,000 lbs of steam per hr—or as large as 250,000 lbs per hr.

There are other important advantages, too. Get the whole story by writing today for your free 14-page booklet with all the facts and figures.

THE AIR PREHEATER CORPORATION

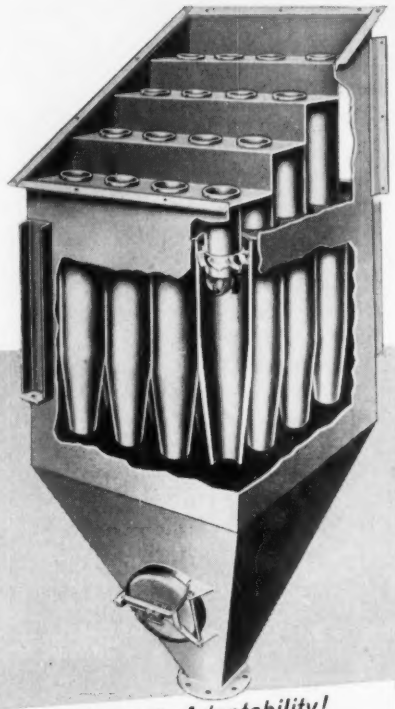
60 East 42nd Street, New York 17, N. Y.

For more facts circle 304 on Reader Service card, p 101

For Modern Fly Ash Control...

Compare

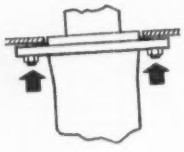
The EXTRA Advantages Built Into MULTICLONE COLLECTORS!



For cyclonic collection of dust or fly ash from all types of gases—hot or cold—no other equipment matches the *multiple* advantages you get in MULTICLONE Collectors. No wonder this small-tube equipment is so widely imitated—but only the genuine Multiclone combines so many important savings as these...

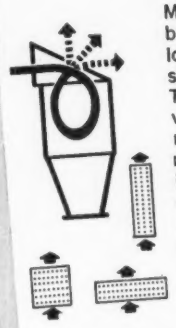
Compare Efficiencies!

Multiclone Collectors pioneered the modern small-tube concept of cyclonic collection. The Multiclone small-diameter tubes combine highest collection efficiency with minimum risk of plugging—and separate not only large, medium and small particles, but also an unusually high percentage of the **extremely small** particles (10 microns and less)!



Compare Maintenance!

Multiclone cast iron tubes and vanes seldom require servicing or replacement. But when unusually abrasive service makes occasional servicing necessary, the tubes (one or more, as desired) can be quickly replaced by simply unbolting the old tube and installing a new one. The cast iron vanes are supported in a tapered seat—are equally easy to service!



Compare Adaptability!

Multiclone Collectors can frequently be placed in otherwise waste-space locations too small—or not properly shaped—for other types of collectors. The shape of the Multiclone can be varied—short and wide, long and narrow, or square—to fit varying space restrictions. Moreover, the unit can be installed with side-inlet, side-outlet—or side-inlet, top-outlet—to fit plant layouts...and only a single inlet and outlet duct is required to service an entire bank of tubes. These multiple advantages add up to important savings in installation, in insulating costs, in space conservation!

Compare Compactness!

In addition to greater space adaptability, Multiclone Collectors also are unusually compact in themselves. For comparable capacity and performance, they require less floor space and less cubic space than do any other cyclonic units. Translate these space savings—plus Multiclone's adaptability to odd-shaped areas—into today's high costs for plant construction and you readily see how important Multiclone compactness really is!

The Above Are Only A Few of the many important advantages you get when you install Multiclone Collectors. Still more are outlined in Multiclone literature that will gladly be sent on request. Write or phone our nearest office for this helpful information!

REMEMBER ...

Western Precipitation is the ONE organization supplying ALL 6 major types of gas cleaning equipment —Precipitator, Cyclonic, Combination, Jet-Cleaned Filter, Hi-Temp Filter and Scrubber. You get a completely unbiased recommendation from Western Precipitation!

Only WP has all 6

1. COTTRELL Electrical Precipitators
2. MULTICLONE Mechanical Collectors
3. CMP Combination Units
4. DUALAIRE Jet-Cleaned Filters
5. THERM-O-FLEX Hi-Temp Filters
6. TURBULAIRE-DOYLE Scrubbers

Also: HOLO-FLITE Processors
HI-TURBIANT Heaters

WESTERN

PRECIPITATION

CORPORATION

M-131

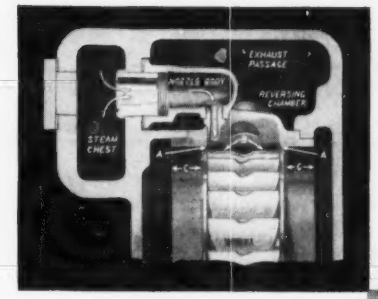
Engineers and Constructors of Equipment for Collection of Suspended Material from Gases . . . and Equipment for the Process Industries

LOS ANGELES 54 • NEW YORK 17 • CHICAGO 2 • PITTSBURGH 22 • ATLANTA 5 • SAN FRANCISCO 4

Representatives in all principal cities

Precipitation Company of Canada Ltd., 8285 Mountain Sights Avenue, Montreal 9

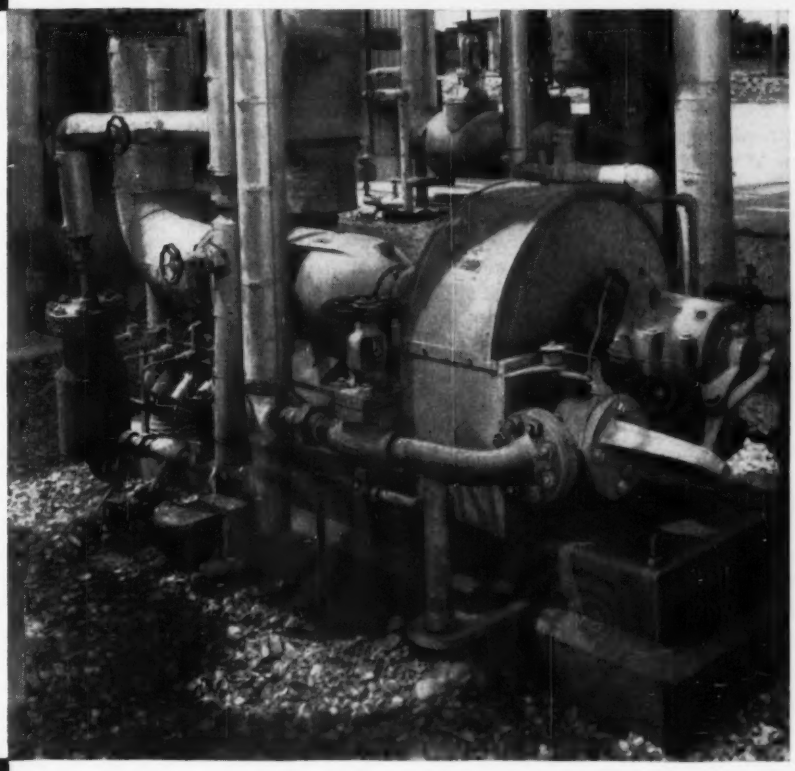
For more facts circle 305 on Reader Service card, p 101



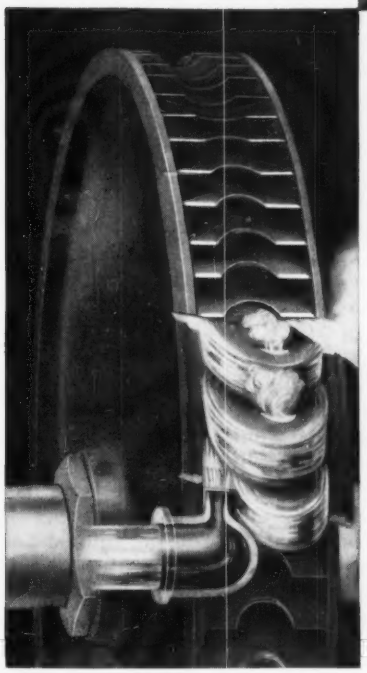
TWO REASONS WHY

this turbine seldom sees down time

1 ***Generous wheel clearances:*** AA —rim clearance, B—blade clearance, CC —side clearance. Blades can't foul as they are protected by rims. Rubbing at AA will do no damage. Side clearance is so large (about one inch) that end-play from excessive external thrust cannot damage wheel.



2 ***Blade wear is of little consequence.*** In a Terry solid-wheel turbine, the steam enters the buckets at right angles to the shaft. As its power-producing action takes place on the curved surfaces at the backs of the buckets, wear does not materially affect horsepower or efficiency.



To prevent costly shutdowns for repairs, Terry builds bonus reliability into each solid-wheel turbine. Two of the ways in which this is accomplished are shown in the diagrams at the left.

Further details of these simple, fool-proof turbines are illustrated and described in bulletin S-116. If you do not already have a copy of this publication, send for one today. No cost or obligation.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1217

TERRY

For more facts circle 306 on Reader Service card, p 101

Powerscope . . . A selective look at

Titanium looks to cost reduction

Titanium, strong as steel and half as heavy, is the fourth most plentiful structural metal found on earth. Titanium metal has been commercially available for the past ten years; tough reduction problems keep production low—only 4500 tons in 1958. Titanium now sells for about $9 a pound in bar and sheet stock. New process developed by Norton Company researchers after seven years of work promises to reduce production costs. Titanium has high corrosion resistance and is now used for aircraft and missile parts. A ship made of this metal would never need painting. In chemical equipment it prolongs life.

Success of the 108-mile coal pipeline from Cadiz, Ohio to Cleveland Electric's Eastlake Station has led to considering a 290-mile pipeline from West Virginia to Philadelphia, Pa. and New York City. The 24-in. line would link mines of Consolidation Coal Company with generating stations of Consolidated Edison Co of N. Y., Inc, Public Service Electric and Gas Co (N.J.), Pennsylvania Power and Light Company and Philadelphia Electric Company. Texas and Eastern Transmission Company would build and operate the pipeline to deliver up to 12 million tons a year to the customers.

Leeds & Northrup Company dedicated its new Research and Development Center at North Wales, Pa. on Sept 18th, 1959. The $2 million installation centralizes company research activities formerly scattered throughout manufacturing plants in the Philadelphia area. The 65,000-sq-ft building can triple in size in future. The center now houses 129 scientists and supporting personnel.

Research budgets boosted

About 600 U.S. corporations boosted their research and development budgets this year by 12% above 1958. New-product expenditures averaged 3.2% of the sales dollar in 1958. The rubber industry topped the list with 9.3% followed by general industrial machinery with 7%. Electrical machinery spent 4.1% and engine and turbine manufacturers only 2% of their sales dollar.

Ground-breaking ceremonies for the new United Engineering Center in New York City were held Oct 1st, 1959. The 18-story structure, opposite the United Nations center between 47th and 48th Streets, will house the headquarters of 18 major engineering societies with a combined membership of over 300,000. Former President Herbert Hoover shared the earth-turning honors with Jerry Fujimoto of Hawaii, a freshman engineering student at Rensselaer Polytechnic Institute at Troy, N. Y. This combination represented the foremost engineer, the newest engineering class, oldest engineering college and newest state.

Nationalist China on the island of Taiwan (Formosa) is in the process of doubling its generating capacity by 1970. The present 1100 mw operating or under construction will grow to 2400 mw. The Ta-chia Valley development will have two concrete dams and six underground power stations. Ta-chien Dam will be the highest arch-type concrete dam in the world, 800 ft, about 80-ft higher than Hoover Dam. The six stations will develop 1300 mw and will be built underground for protection against natural hazards.

Another peaking unit

Central Vermont Public Service Corp has ordered its fourth General Electric gas turbine. This 20.5-mw unit will be used for peaking and is scheduled to start running in mid-1962. The turbine is rated for 80-F inlet air when burning distillate oil; at 0 F it can develop 28.0 mw. This is the third peaking gas turbine sold by GE; the others will go to Philadelphia Electric Company and the New Orleans Sewerage and Water Board. PE also ordered a Westinghouse Electric peaking gas turbine.

The Clinchfield Coal Company Division of the Pittston Company now runs a completely automatic coal preparation plant that washes, dries, screens and ships coal twice as fast as the miners can produce it. Ten men supervise the plant through an advanced General Electric control system. Plant can process 1500 tons per hr of coal.

"Protective Maintenance of Motors and Generators," a 63-p booklet for maintenance men, has been produced by the Renewal Parts Section of the National Electrical Manufacturers Association. Booklet has an appendix containing NEMA standards for classification of coils, insulating materials, replacement commutators and assembled segments, authorized engineering information on armature-winding supplies, guides for maintaining continuous operation of motors and generators, preservation of re-

this month's power-field happenings

B G A SKROTZKI, Associate Editor

newal parts for electrical rotating apparatus and proposed definitions of renewal parts. Four forms in the back help keep records of motor, generator and control maintenance. For free copy write NEMA Headquarters, 155 E 44th St, New York 17, N. Y.

Cooling infrared-target detectors increases their sensitivity and makes them more effective. Arthur D Little, Inc, researchers have developed a "supercold" refrigerator the size of a flashlight battery to serve airborne detectors. The 8-oz refrigerator, called the MinIRcooler, chills detectors to –350 F. It has a ¼-in.-dia 2-in.-long cylinder with a plastic piston, as the only moving part, to expand and cool helium refrigerant. Cooler needs only three min to develop –350 F.

Gas-turbine record plant

World's largest gas-turbine station, Port Mann of the British Columbia Electric Power Company in Canada, was commissioned on Oct 2nd, 1959. The plant with four Brown Boveri units has a rated capacity of 100.5 mw. It will burn either natural gas or oil. Plant will be remotely controlled from the dispatching office in Vancouver through microwave signals. It can be fully loaded from cold in 20 min. Units will run as peaking units; as hydro-plant backup when water is low.

Greater part of the discharge from Wairakei, New Zealand, steam bores is water at high temperature and pressure. Present plant separates the steam from the hot water to generate 69 mw, and wastes the hot water. A new project will collect this water at the wellheads at 350 psig and 410 F and pipe it about three-quarters of a mile to flash tanks held at slightly above atmospheric pressure. Flashed steam will generate 11 mw in a l-p condensing turbine.

The U.S.S.R. has worked up preliminary plans to develop 2.5-million-kw electric capacity from the wind in its Kazakhstan SSR. The system would use 10,000 electric plants of 250-kw capacity each, and would include oil-engine plants to start on windless days, maintain power supply.

Biggest U.S.S.R. hydro coming

The U.S.S.R. plans another record-breaking hydro power plant on its Jenessej River in Siberia. The plant will have a capacity of 6000 mw with individual unit capacities of 450 to 500 mw. This compares with the 2000-mw capacity of its Kujbechev hydro plant, world's largest. Plans call for building the plant during the next six years. The plant is expected to produce 35-billion kwhr yearly, about one-seventh of the U.S.S.R. output for 1958. This energy would be delivered to the Siberian grid or transmitted more than 1500 miles to the industrial center of the Urals.

Cornell University has been chosen by the Association of Edison Illuminating Companies and the Edison Electric Institute to develop underground high-voltage high-capacity cable. Cable will have a nominal rating of 350 kv and 500 mva. Project will cost over $1.5 million. Cables for testing have been submitted by Anaconda Wire and Cable Company, General Cable Corp, The Okonite Company and Phelps Dodge Copper Products Association. Equipment will be supplied by Anaconda Wire and Cable Company, The Brewer Titchener Corp, General Electric Company, G&W Electric Specialty Company, Joslyn Manufacturing and Supply Company, The Ohio Brass Company and Westinghouse Electric Corp. Testing station, just outside Ithaca, N. Y., will be ready this fall. A university lab was chosen to stimulate engineering-student interest.

Control cuts heating cost

Centralized control at the East Pittsburgh, Pa., works of Westinghouse Electric Corporation has made large savings in operation of the steam-heating system. Steam can be shut off from any area promptly and the entire heating system can be closed down in one minute. Large steam loads can be controlled to meet peak loads as they develop. Operator maintenance time has been cut from 1730 man-days to 415 man-days annually. Steam consumption has been reduced from 750 to 600 million lb yearly.

City and military officials in Colorado Springs, Colo., area are considering asking the federal government to build an atomic power plant in the district. The Public Works Bill signed by President Eisenhower included $10 million to start building the underground North American Air Defense Command Headquarters at Cheyenne Mountain, southwest of Colorado Springs. Air Force may build a standby atomic plant here.

The United States Patent Office issues patents at the rate of about 1000 per week. A total of 2,891,000 have been issued since 1790.

MOST COMPLETE LINE

Eleven Product Groups Serve Every Sealing Need

GROUP NO. 7

Sheet Packings

Forty-two styles of superior Sheet Packings are offered in the Belmont Line.

Unmatched variety of constructions—to suit every sheet packing requirement in service against steam, oil, solvents, corrosive chemicals and extremes of temperature—includes compressed asbestos, woven asbestos metallic, "Petrola" fibre, cork, red rubber, natural rubber, G.R.S., Neoprene, Buna-N, Silicone, Diaphragm sheet and Teflon.*

Cut gaskets are also available from all of these materials.

See your Belmont Distributor, or write for name of one nearest you.

OTHER BELMONT PRODUCT GROUPS

1. High Pressure Asbestos Packings
2. Valve Stem Packings
3. Rotary Pump Packings & Seals
4. Criss-Cross Braided Packings
5. Hydraulic Packings
6. Bel-Vee V-Rings
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MOST CONVENIENTLY AVAILABLE

Nationwide Industrial Distributor Organization Provides On-the-Spot Service

*du Pont Trademark

BELMONT

The Belmont Packing and Rubber Company
Butler & Sepviva Streets, Phila. 37, Pa.

Reports from the field

Ted Edwards is latest addition to *Power* masthead

Taking the editorial mantle from Associate Editor Bob Marks, now with Pfaudler-Permutit, is Ted Edwards, POWER's newest Assistant Editor. He'll handle technical areas of valves and piping, water and waste treatment, pumps and compressors.

Ted graduated from Virginia Polytechnic Institute with a BME, then earned a MS in sanitary engineering at Newark College of Engineering. Twelve years with Worthington Corporation followed; Ted rose to manager of the boiler-feed pump section, meanwhile trying his hand at technical articles — some published in POWER.

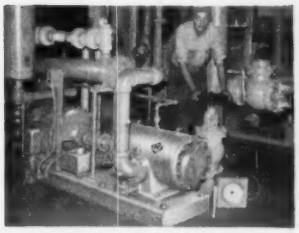
A native of New Jersey, Ted drives a flashy red MG at legal speeds (car won't go any faster, he claims.) He plays left-handed golf, and his latest experiment is sailboating with 11-year-old Ted Jr. Two younger sons and a beautiful Southern wife complete the Edwards menage.

Earthquakes add problems to nuclear-plant construction

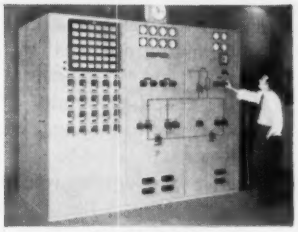
Earthquakes, always a threat to industrial plants, would be especially dangerous to a nuclear plant. R R Alvy, chief engineer of the Nuclear Division of Holmes & Narver, told the ASCE that more refined earthquake designs are necessary to protect nuclear-power facilities. **continued**

In pace with POWER... **ALLIS-CHALMERS**

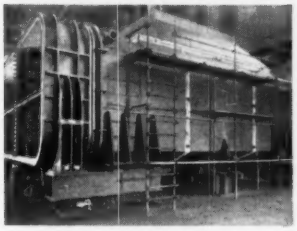
ALLIS-CHALMERS



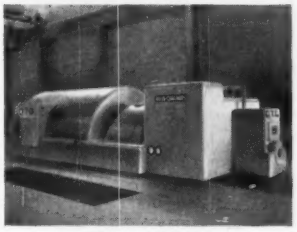
COMPRESSORS



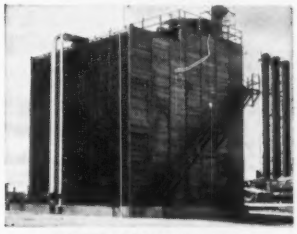
SWITCHGEAR



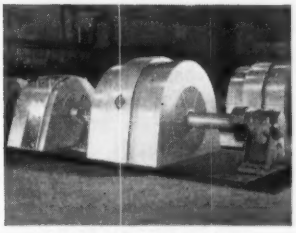
CONDENSERS



STEAM TURBINES



WATER CONDITIONING



MOTOR-GENERATOR SETS

Coordinator for a talent task force...

...he's your Allis-Chalmers man

This task force of experts bulwarks the Allis-Chalmers man. Their purpose: To offer comprehensive, single-source services to help you with preliminary power system planning, erection and operation.

Call the A-C man in *early*... to put these researchers, engineers, field service men and other specialists to work on your next power project. He'll make recommendations... coordinate schedules of individual products to entire power systems. And you get all the benefits of Allis-Chalmers parts and service programs.

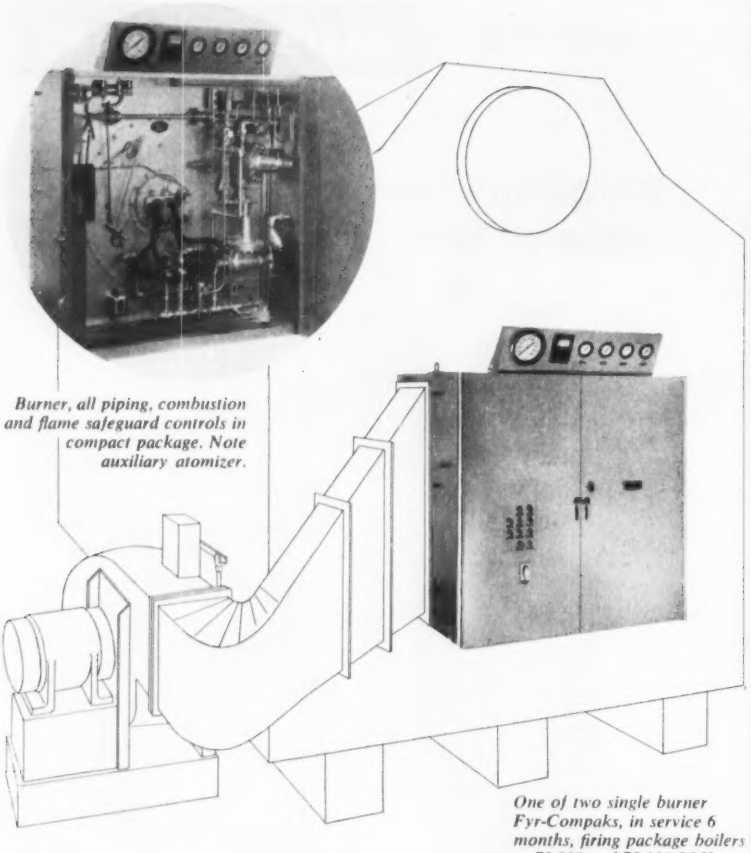
On the following pages, you'll see a few of the power products offered. Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

A-1170-PR

ALLIS-CHALMERS

For more facts circle 308 on Reader Service card, p 101



Burner, all piping, combustion and flame safeguard controls in compact package. Note auxiliary atomizer.

One of two single burner Fyr-Compaks, in service 6 months, firing package boilers to 70,000 and 78,000 PPH at Halifax Paper Co.

Now! 100,000 PPH/STEAM WITH SINGLE BURNER SIMPLICITY!

With the new Fyr-Compak® Model 60 NF, Coen Company now provides the greatest single burner per boiler heat release available to industry. Steam flow ratings as high as 100,000 PPH and all the operating advantages of single burner simplicity have been made possible by use of the exclusive Coen DAZ (Dual Air Zone) Register, which assures a narrower, but not longer, extremely uniform flame pattern. In addition, the new Fyr-Compak gives you:

- Metering control—electric or pneumatic
- Guaranteed 10 to 1 turndown on gas OR oil (Coen "VO" metering)
- Integral annunciator panel and two flame safeguard relays
- Uninterrupted operation on momentary power failure
- Auxiliary atomizer for 100% heat availability during gun change
- Insulated register and windbox when used with preheated air

Since its introduction last spring, the Model 60 NF unit has received enthusiastic acceptance. If you are considering single boiler high steam capacity, be sure to also consider the single burner simplicity of a Fyr-Compak . . . it's the finest burner any boiler can have. Write for full information.

Combustion Engineers and Manufacturers

SINCE 1912 COEN

COEN COMPANY

40 Boardman Place • San Francisco 3

FYR-COMPAK® GAS AND OIL BURNERS: FYR-MONITOR® FLAME SAFEGUARD SYSTEMS
FUEL OIL PUMPING HEATING & STRAINING SETS: AIR HEATERS: KILN BURNERS

Representatives in principal cities throughout the world

Reports from the field

Begins on page 158

In the conventional industrial plant, 'quake damage would be limited to the immediate plant area — release of steam or falling debris. But the nuclear plant adds radioactivity as a potential danger. If cooling water were cut off by tower collapse or piping failure, the reactor might melt and release large quantities of radioactive fission products into the vapor container. Any structural weakness in the container would let contaminants escape to endanger nearby communities.

With earthquakes possible anywhere, Alvy concluded, no major reactor facility should be designed without allowing for ground motion. Foresight can avert future disaster.

Longest evaporator goes in atom power plant

Giant evaporator is one of two built for the Indian Point nuclear power station of the Consolidated Edison Company of N. Y., Inc.

Built by The Griscom-Russell Company, unit is 65-ft long, weighs 87,000 lb. It will produce 65,000 lb per hr of vapor at a pressure of 62 psia. Impurities in the vapor should be less than 0.25 ppm.

Tandem tube bundles are supplied with 110-psia 750-F steam extracted from station's turbine. Pure water produced will be converted to steam by nuclear-reactor-heated steam generators and used to drive 275,000-kw turbine and electric generator.

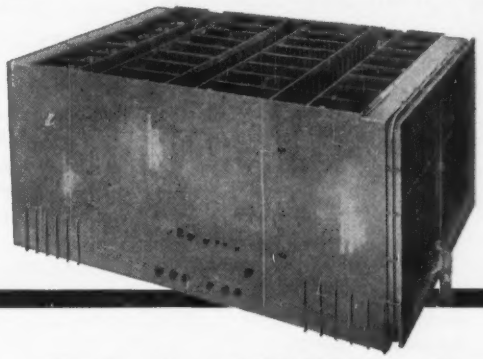
Make training programs brief, says industrial expert

Give young scientists and engineers responsibility for a specific assignment as soon as possible, Prof J W Riegel of U of Michigan tells industry. Make your formal introduction to company products and processes brief, or present it on a part-time basis while the man works on some practical project.

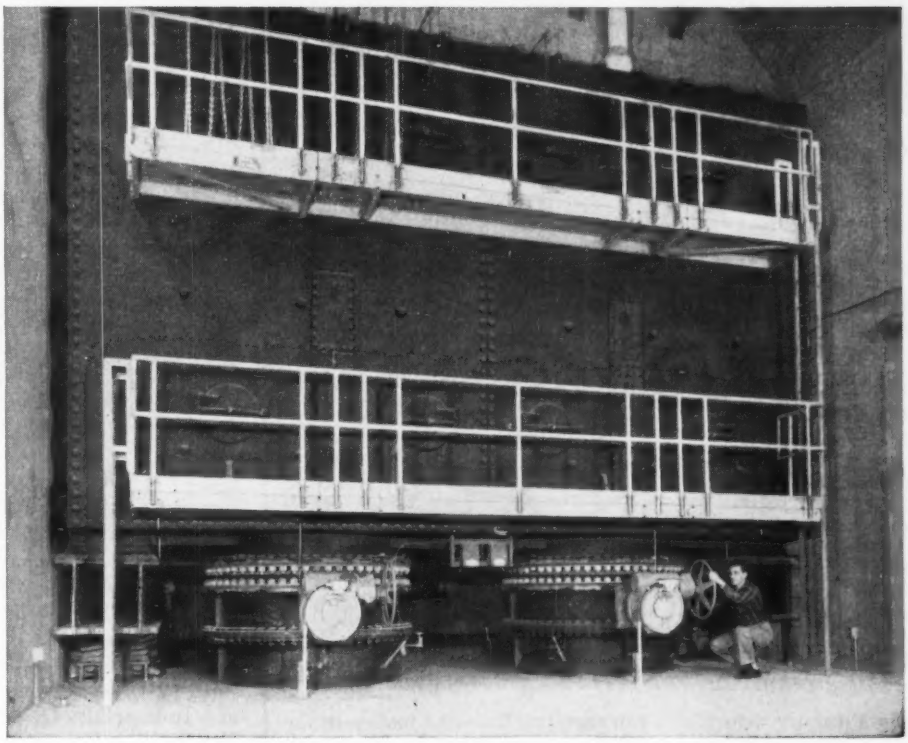
After the new employee has gradually learned about his company while helping to "earn his keep," Riegel believes individual programs for self-development should be started:

ALLIS-CHALMERS

In pace with POWER... ALLIS-CHALMERS



Today's BIGGEST Condenser



200,000-square-foot condenser now in operation at Fisk Station of Commonwealth Edison

Some man-sized problems were presented by this unit... not the least of which were shipping and erection. Special Allis-Chalmers well-center cars permitted shipment of the entire shell in only four sections. Special alignment techniques developed by A-C cut installation time.

Today it serves a 327-mw Allis-Chalmers steam turbine generator. Note the compact, space saving rectangular shape pioneered by Allis-Chalmers and made practical by the A-C guided-flow condenser design.

For help on your condenser problems, large or small, contact your nearby A-C office or Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

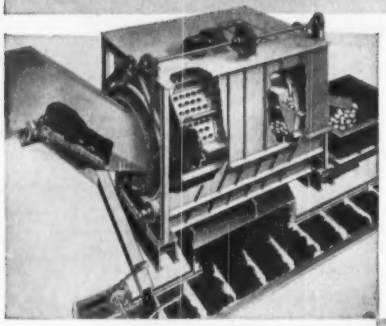
A-C ALLIS-CHALMERS

A-1046-PR

ALLIS-CHALMERS

More and more utilities now use this

Rugged Cost Cutting Coal Processing Equipment

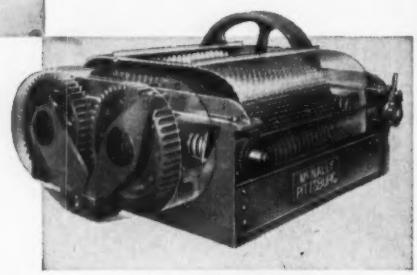


McNally Pittsburg Rotary Breaker

This heavy-duty unit allows positive control of top size in handling run-of-mine washery feed. Production of fines is held to a minimum. Without center shaft or spoke interference, costly maintenance is usually drastically reduced.

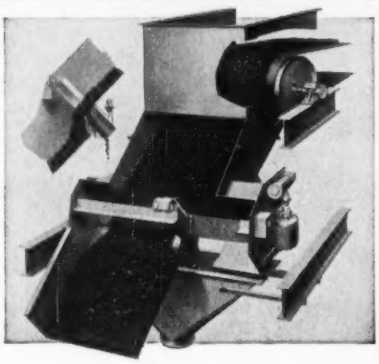
Gearmatic Stoker Coal Crusher

Built to handle heavy coal tonnages, these crushers have proved most efficient to reduce 8" minus to stoker grades. They offer three major advantages: 1) high volume production; 2) accurate sizing; 3) low percentage of fines.



McNally Pittsburg Primary Coal Sampler

This automatic sampler (adjustable from 1 to 30 minutes) cuts out true samples of the coal stream. Cutter opening permits largest particle of stream to pass freely into cutter. Conveyor discharges into chute in which sampler is installed.



Ask the men who know coal from the ground up!

Your McNally Pittsburg man offers more than 37 years of experience in the preparation of coal. He can save *you* time and money in the selection of equipment to do your job more efficiently. *Write today!*

McNALLY PITTSBURG

MANUFACTURERS OF EQUIPMENT TO MAKE COAL A BETTER FUEL

McNally Pittsburg Mfg. Corp.
Dept. P, Pittsburg, Kansas
Gentlemen: Send me more information on these products:
☐ Rotary Breaker ☐ Coal Crusher ☐ Primary Coal Sampler

Name_____ Title_____

Company_____

Address_____

City_____ State_____

Reports from the field

Begins on page 158

Let your man prepare an annual progress report, telling what he has done and would like to do. Show research and development men how their ideas are being carried out. Above all, encourage exchange of ideas among professionals through technical department meetings, seminars and scientific sessions.

Calendar of Events

Nov 2-5—American Institute of Mining, Metallurgical and Petroleum Engineers, Metallurgical Society Div, Fall Meeting. Morrison Hotel, Chicago, Ill. Details: AIME, 29 W 39th St, New York 18, N. Y.

Nov 2-5—Air-Conditioning and Refrigeration Institute, 11th Exposition. Convention Hall, Atlantic City, N. J. Details from ARI, 1346 Connecticut Ave, NW, Washington 6, D.C.

Nov 5-6—Louisiana Polytechnic Institute, School of Engineering, Eighth Annual Instrumentation Conference. LPI campus, Ruston, La. Details from Stewart Baggarly, publicity chairman, LPI.

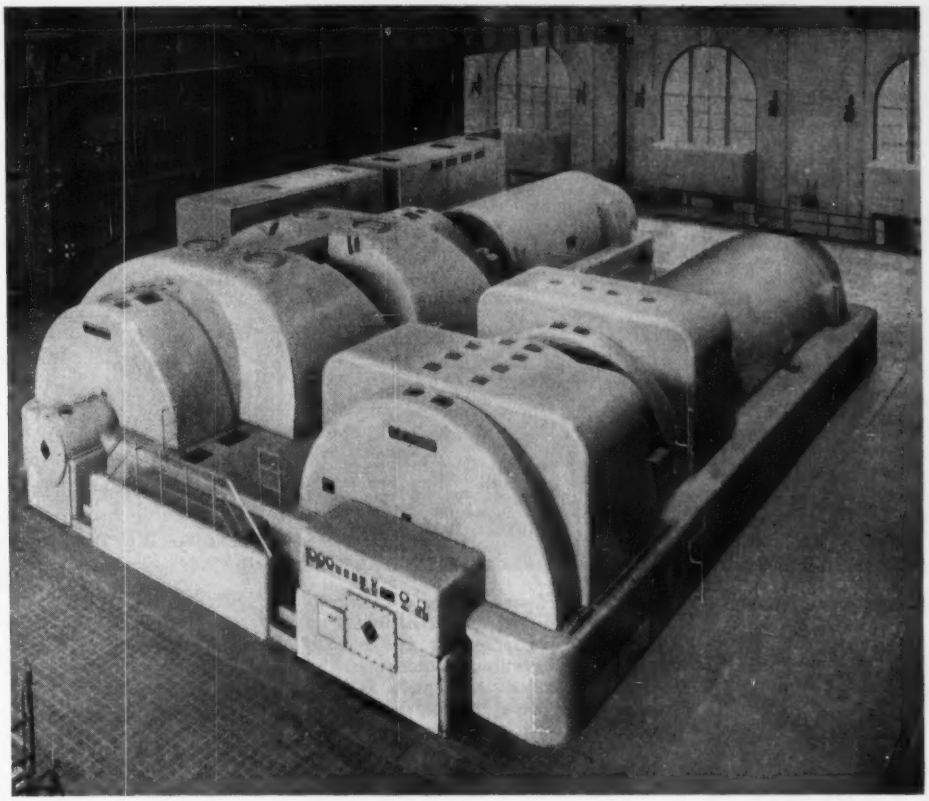
Nov 12-13 — American Society of Industrial Designers, Fall Meeting. Hotel Statler, New York. Details: ASID, 15 E 48th St, New York 17, N. Y.

Nov 23-24—Instrument Society of America, Philadelphia Section, with cooperation of AIEE and IRE, Symposium and Equipment Display. Benjamin Franklin Hotel, Philadelphia. Details from F G Daveler, International Resistance Co, 401 N Broad St, Philadelphia 8, Pa.

Nov 29-Dec 4—American Society of Mechanical Engineers, Annual Meeting. Chalfonte, Haddon Hall

ALLIS-CHALMERS

In pace with POWER... ALLIS-CHALMERS



327-167-kw close-coupled, cross-compound 3600/1800-rpm unit — separate excitation m-g sets in cubicles, upper right. Steam conditions: 2000 psig, 1050 F at inlet, 1000 F reheat, 1 inch Hg absolute exhaust pressure.

Commonwealth Edison's new 327,167-kw Fisk 19 doubles station output

This steam turbine generator, the second of several such Allis-Chalmers units to go into service, is equipped with record 46-inch long exhaust blades. The unit's 200,000-sq-ft Allis-Chalmers condenser, too, is of world-record size.

Notable among today's generation achievements, Fisk 19 employs close-coupling with short crossunders, a ring-type nozzle chest, side-mounted turning gears, a double-flow intermediate pressure turbine and a fully supercharged 3600-rpm generator.

To learn more about these and other design features of Allis-Chalmers tandem and cross-compound units, see your nearby A-C office or write to Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

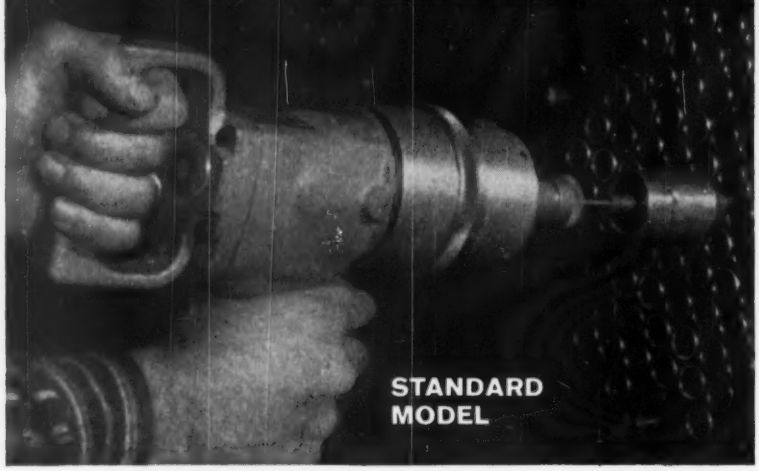
A-C ALLIS-CHALMERS

A-1154-PR

ALLIS-CHALMERS

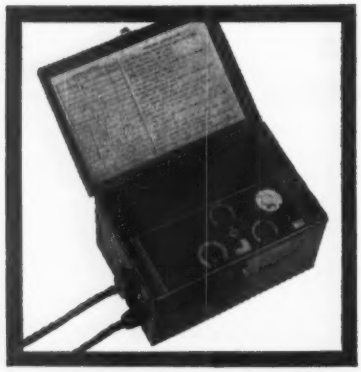
ELLIOTT air magnetic tube expander drives

automatically controlled for fast, accurate tube rolling



Designed for faster, precision tube rolling, the standard model Elliott Air-Magnetic drive is setting new records for speed and accuracy. Some operators average 12 tubes per minute. Desired torque easily preset by rotating forward end of unit. No tools needed. Rolling stops when preset torque levels are reached. Includes trigger-controlled, explosion-proof air motor in single unit. Magnetic control, no springs. Balanced for easy handling. For tubes ¼ in. through 3 in. *Standard model* handles most jobs. *Heavy-duty* for higher torque.

ALSO Electric Control ... Tube Expanders ... and Related Accessories



Elliott offers the Automatic Electric Control—an accurate torque-limiting device designed for tube expanding with any standard tapping motor. Also, a complete line of tube expanders, with rotating, parallel, self-feeding rolls. Available in 4 sizes, ranging from ¼ in. to 3½ in. O.D.

Other related accessories include Elliott tube gage, tube plugs, tube pilot, and tube rolling lubricant.

Write for descriptive literature *today*.

Y9-3

ELLIOTT Company
LAGONDA PLANT, Springfield, Ohio

Reports from the field

Begins on page 158

Hotel, Atlantic City, N. J. Details from ASME Meetings Dept, 29 W 39th St, New York 18, N. Y.

Nov 30-Dec 4—27th Exposition of Chemical Industries, New York Coliseum. Details from E K Stevens, 480 Lexington Ave, New York 17, N. Y.

Dec 3-4—National Science Foundation will sponsor a conference on research goals. Worcester Polytechnic Institute, Worcester, Mass. Details: Boynton Hall, WPI, Worcester, Mass.

Dec 8-10—American Institute of Electrical Engineers and National Electrical Manufacturers Association (cosponsors), National Conference on the Application of Electrical Insulation. Shoreham Hotel, Washington, D.C. Details: T F Hart, Union Carbide Corp, 30 E 42nd St, New York 17, N. Y.

Japan's largest turbine goes underground

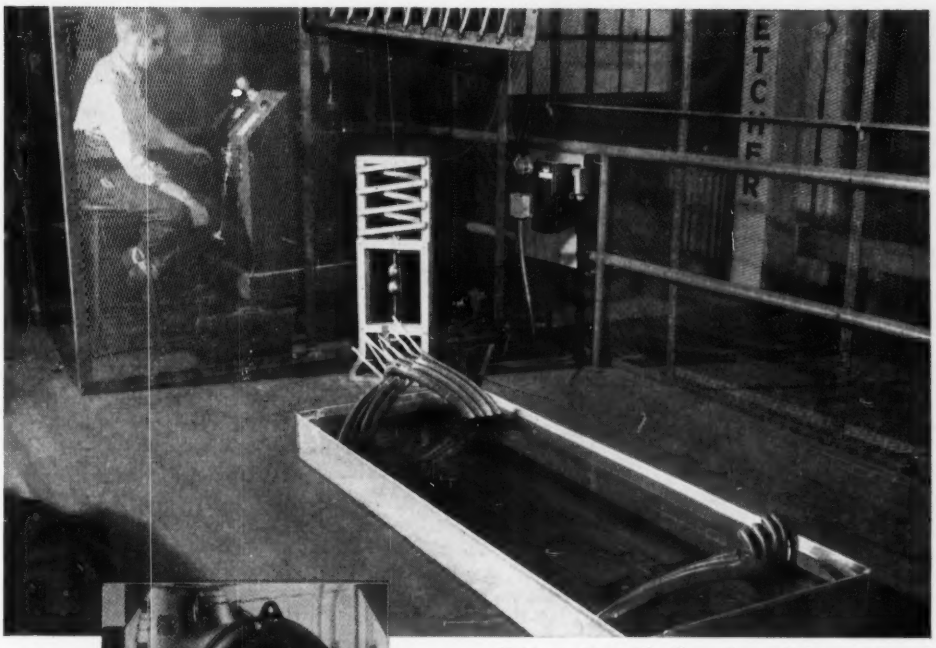
TOKYO (*McGraw-Hill World News*) —Japan's largest, a 150,000-kw water turbine, was recently put out by Toshiba Electrical, destined for installation at Okutadami Dam's underground power plant.

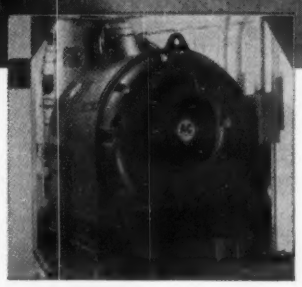
A spiral francis type unit, turbine has an effective head of 650 ft, takes 274 cu ft water per sec at standard head of 561 ft. Spiral casing, above, awaits shipment at the Toshiba plant. The 200-rpm turbine is one of three ordered.

continued

For more facts circle 313 on Reader Service card, p 101

ALLIS-CHALMERS





Moisture-resistant *Silco-Flex* coils are high-potential-tested under water, with test voltage applied for one minute between conductor and water bath.

Super-Seal coil foils water

"Hi-pot" tests under water prove moisture resistance

Remarkable insulation systems combined with advanced mechanical features provide a completely new concept in motor protection — the *Super-Seal* motor. This motor gives you complete protection from moisture, fly ash, and other contaminants, even with so-called drip-proof motor enclosures.

New motor is protected with *Silco-Flex* stator coil insulating system: A homogeneous, void-free dielectric barrier of vulcanized silicone rubber so moisture-proof it can be hi-potted under water, cleaned by hosing down. Resists most corrosive or chemical atmospheres.

Integrated field coils in synchronous machines are completely sealed against contaminants, bonded and locked against mechanical forces.

For additional information, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Super-Seal and Silco-Flex are Allis-Chalmers trademarks.

A-C ALLIS-CHALMERS

A-5992-PR

ALLIS-CHALMERS

Good Pair to Know!

Chances are you won't have to look far to find a spot for one of these float-operated switches.

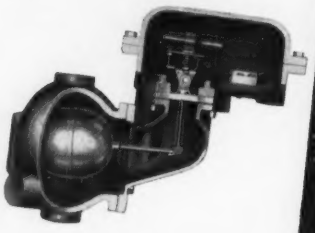
They have been specially developed by McDonnell to serve two broad fields of application. They answer a lot of operating problems that you may have thought could be handled only by make-shift or much more expensive equipment.

Dependable and time tested, they are just two of hundreds of products developed by McDonnell for liquid level or liquid flow control. When you choose from the complete McDonnell line it's good to know you draw on unmatched experience and know-how in this specialized field.

McDonnell No. 65
Explosion Proof Electric Controller

Underwriters' Listed for use in hazardous locations:
Class 1, Group C & D
Class 2, Group F & G

A float-operated switch for use under hazardous conditions, such as atmospheres containing butane, benzol, lacquer solvent, alcohols, acetone, coal and grain dust, etc. Can be furnished to make or break electric circuit at high- or low-level — to control motors, signal lamps, electric elements, etc. Suitable for internal pressures up to 40 psi.



Write for McDonnell Engineering Bulletin ERS-10 which discusses typical applications of No. 65, shows wiring diagrams for different patterns of operation.

McDonnell No. 80
High- or Low-Level Switch

Underwriters' Listed for use on oil tanks.

A float-operated three-terminal switch that can be used to provide high- or low-level alarm, or to start or stop a pump when level rises or falls. It makes possible reliable automatic control in place of gauge glass watching and manual control.

Write for McDonnell Engineering Bulletin ERS-9 which shows typical application of No. 80 on oil storage tanks, complete with wiring diagrams for draining or filling tanks, high- or low-level alarm, signal or cut-off.

Write for complete literature and engineering bulletins.

McDONNELL & MILLER, *Inc.*, 3506 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

REG. U. S. PAT. OFF.

Your Jobber Stocks Them

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BOILER WATER FEEDERS • LOW WATER FUEL CUT-OFFS • PUMP CONTROLLERS • RELIEF VALVES • FLOW SWITCHES • RELATED LIQUID LEVEL CONTROLS FOR TANKS, STILLS, AIR CONDITIONING SYSTEMS

Reports from the field

Begins on page 158

New hydro plant reuses river waters

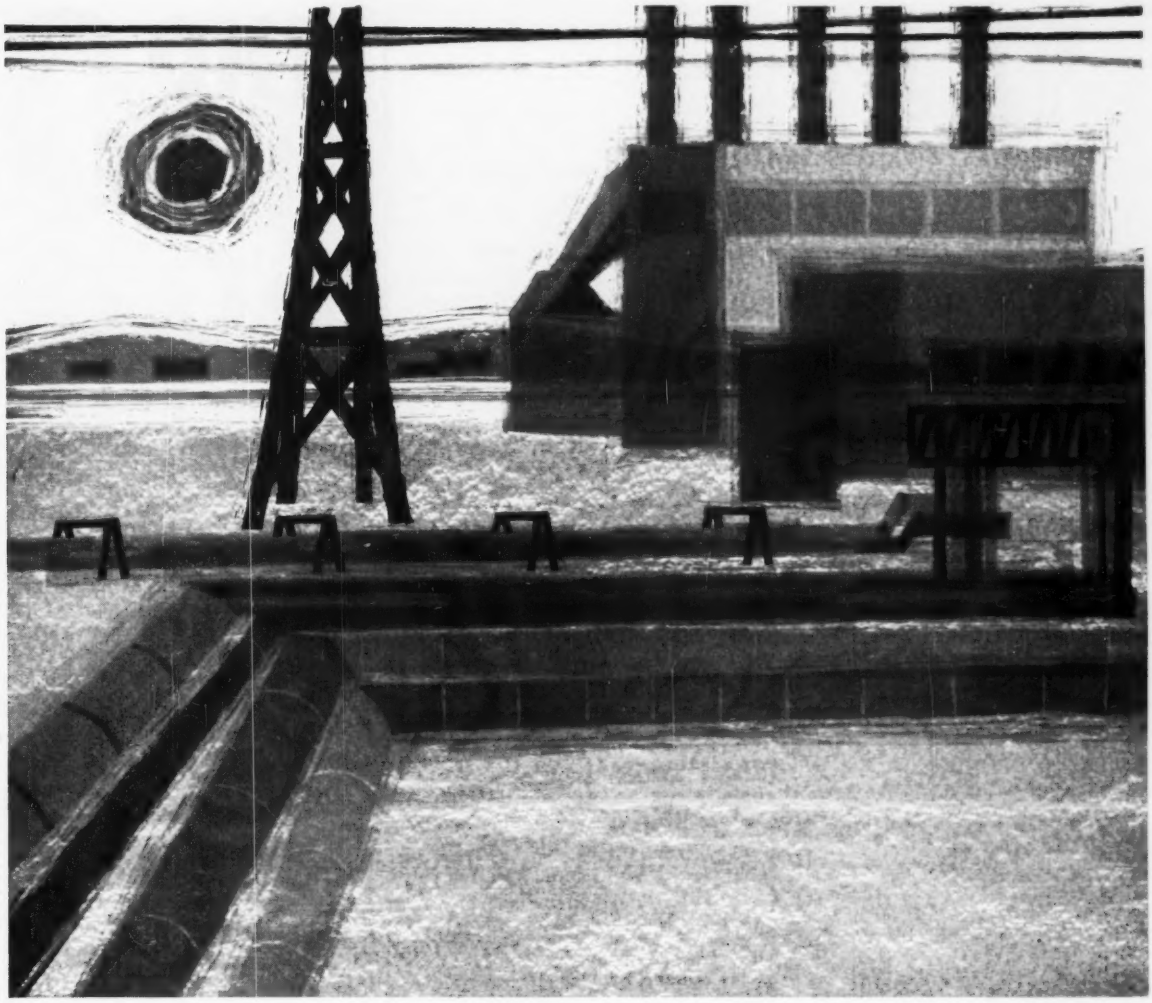
MILAN, ITALY (McGraw-Hill World News) A hydroelectric power plant reusing the waters of the Tagliamento and Lumiei Rivers discharged by another plant has been inaugurated at Somplago, near Lake Gavazzo in Friuli, northeast Italy. Plant has five 55,000-kw units, generating a total 275,000 kw.

Waters let off by the Ampezzo Carnico plant are channeled to the reservoirs of Ambiesta at Verzegnis through a 24.9-mile tunnel network under a mountain. Ambiesta reservoirs impound 2880 acre-ft of water. The arch type dam is 197 ft high.

Forged beryllium helps break materials roadblock

In the nuclear field, we need materials exhibiting good structural properties at low and very high temperatures, and at the same time meeting severe demands in nuclear compatibility, thermal shock, corrosion resistance. Fusion power systems will present even more problems, as Dr. J A Stratton, president of the Massachusetts Institute of Technology, pointed out in a speech recently delivered before a group of educators.

One answer to the materials bottleneck has been suggested by the Wyman-Gordon Company U.S.A.F. plant at North Grafton, Mass. There, the first large berryllium part ever forged



HOW CAN ALUMINUM JACKETING SERVE YOU BETTER AT LESS COST?

You'll find the answer to this, and many other questions concerning aluminum jacketing, in Kaiser Aluminum's free 40-page brochure, "Insulation Jacketing Materials and Methods."

How does the installed cost of aluminum jacketing compare with other insulation finishes? How can dry-wall construction techniques save you labor time and money? What are "snap jackets" and how can they cut installation costs? How do aluminum's advantages of superior corrosion resistance and durability work in your favor, saving you hundreds of dollars over the years?

The answers to these questions can save you money on installed costs and maintenance costs. They're all here—plus full information on aluminum jacketing alloys, fasteners, applications, specifications.

Send for Kaiser Aluminum's "Insulation Jacketing Materials and Methods" brochure now. Mail the coupon!

Kaiser Aluminum construction industry specialists are available to offer immediate engineering assistance on the use of aluminum for insulation jacketing, boiler lagging or other applications in your industry. Contact your nearest Kaiser Aluminum sales office for full information.

KAISER ALUMINUM

Kaiser Aluminum & Chemical Sales, Inc.
Dept. IB-6, 1924 Broadway
Oakland 12, California

Please send me your free brochure, "Insulation Jacketing Materials and Methods."

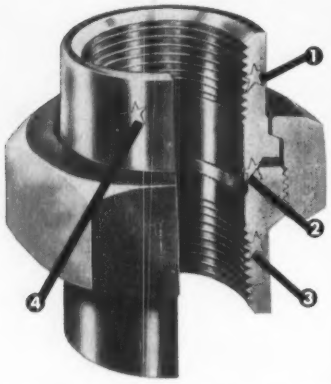
NAME_____

ADDRESS_____

CITY_____ **STATE**_____

For more facts circle 316 on Reader Service card, p 101

only
CATAWISSA
gives you all these features for your forged steel pipe union requirements



1. **Uniform walls** for even expansion and contraction under temperature changes. They follow the pipe!

2. **Catawissa Ball-to-Angle Seats** give you a "Perfect Seal" regardless of pipe alignment!

3. **More than adequate** wall thicknesses give you Catawissa's 3-to-1 Safety Factor (3000-lb. service, 9000-lb. test; 6000-lb. service, 18000-lb. test)!

4. **Round, straight barrels** for fast wrenching. No uneven or tapered surfaces to cause wrench slips or wrench locking!

Catawissa Perfect Seal Pipe Unions are made by Union Specialists from 80,000 lb. tensile strength steel (ASTM Spec. A-105-55T, Grade II). Steel forgings from our own forging mill are closely checked for imperfections . . . and finishing on modern, automatic machines with close inspection during and after production give you pipe unions second to none!

Write for Catalog 58 showing the complete Catawissa line of Perfect Seal Products.

for complete, guaranteed satisfaction

. . . always specify
CATAWISSA

CATAWISSA VALVE & FITTINGS CO.
CATAWISSA • PENNSYLVANIA

Reports from the field

Begins on page 158

successfully was recently produced on the bed of a 18,000-ton forging press, p 166. Most difficult of the exotic metals to form, magnesium-light beryllium has only one critical limitation to use in space flight, atomic reactors—its brittleness. Newly developed closed-die forging promises to eliminate the brittle behavior, produce a more ductile material and shapes needing a minimum of machining.

Among the advantages of beryllium are lightness, modulus of elasticity 1½ times that of steel, good resistance to radiation, high heat capacity. Wyman-Gordon will use larger forging presses, including a 50,000-ton one, to shape larger and more complicated forms of beryllium in the future.

Materials-handling authority retires as board chairman

Bernard C Berry, board chairman of The Allen-Sherman-Hoff Company, a division of A-S-H Industries, Inc, has retired from active management duties. He will continue to act in a consulting capacity.

Beginning as manager of production service and erection in 1929, Berry was promoted to manager of the firm's New York office and later general sales manager. In 1950 he was elected president and in 1955 board chairman of the bulk materials-handling systems company.

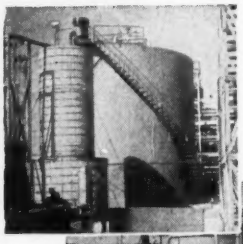
Berry is a Life Member of the ASME, an active member of the AIME and a recognized authority in the power field and allied industries.

Injury repeater is imprudent, easily distracted, disinclined to accept rules, self-assured and aggressive, according to industrial consultants. The wise guys and the bumblers cause most industrial accidents.

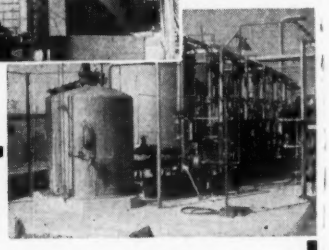
Safety know-how and resources must be extended beyond the factory gate, says National Safety Council. Keep workers safe *off* the job, too.

WHO CHOSE H&T?

For Boiler Feedwater Conditioning Equipment



400,000 lb. per hour fully automatic demineralizer plant with silica and CO_2 removal



These Fine Companies Did!

A Partial List of Installations

Duquesne Light Co.
Shippingport, Pa.

Yankee Atomic Electric Plant
Rowe, Mass.

Ohio-Edison Co.
Akron, Ohio

Bowaters-Carolina Corp.
Catawba, S.C.

Knolls Atomic Power Laboratory
West Milton, N. Y.

The Cleveland Elec. Illuminating Co.
Ashtabula, Ohio

Chevrolet Div. Gen. Motors Corp.
Tarrytown, N. Y.

R. J. Reynolds Tobacco Co.
Stokes County, N. C.

Tampa Electric Co.
Tampa, Florida

U. S. Gypsum Co.
Chicago, Ill.

Send for new Bulletin
50 Years of Progress

HUNGERFORD & TERRY, Inc.
CLAYTON 3 NEW JERSEY
H&T SERVICE

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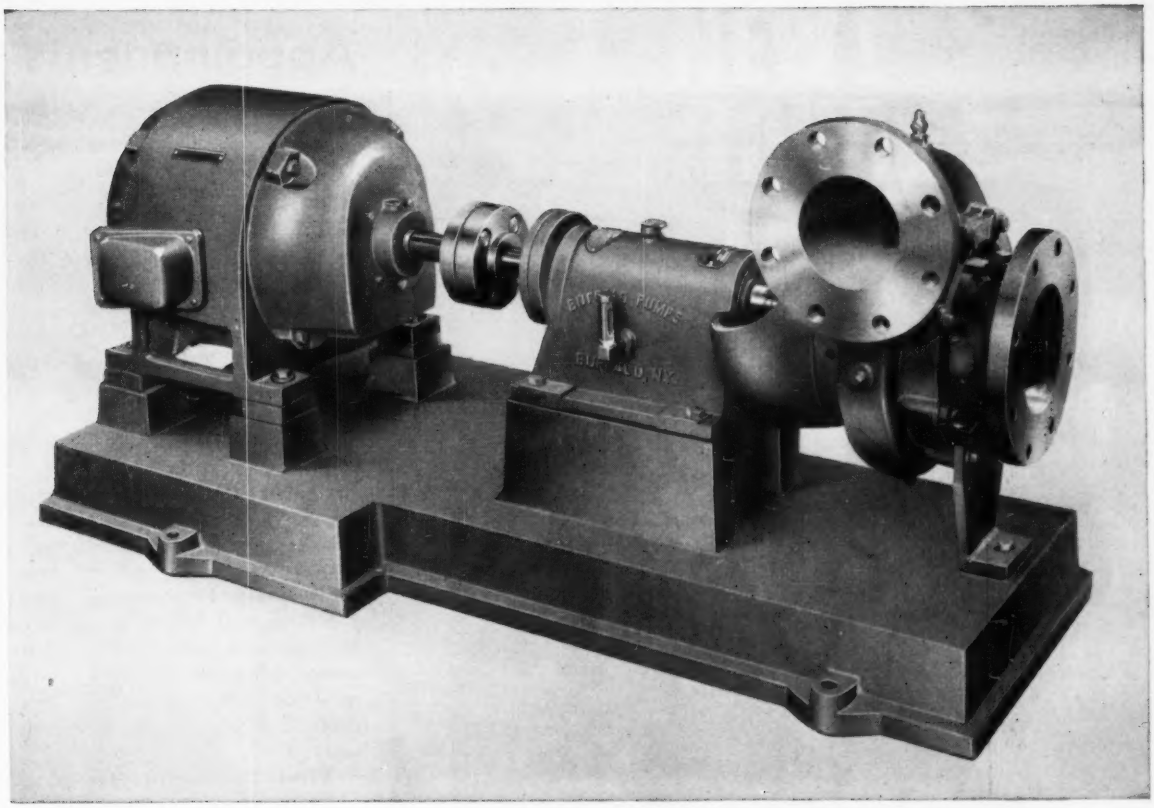

YOU SAVE ON MAINTENANCE 3 WAYS WITH "BUFFALO" SINGLE SUCTION PUMPS!

1. Easier Accessibility to Inner Working Parts Cuts Servicing Time:

Open design mounting bracket allows quick access to stuffing box for gland adjustment.

Renewable wearing rings protect casing from wear. Rings only (not casing) need be replaced.

2. Interchangeability of Parts Thru Standardization of Parts Further Decreases Maintenance Costs:

Lower parts inventory costs and stocks.

Simplified, less costly inventory control.

3. Rugged "Buffalo" Construction Assures Long, Dependable Life & Minimum Maintenance:

Full ball bearing construction means long bearing life.

Long **overall** life is provided by oversize shafts, bearings, stuffing boxes — heavy-duty casings, stands.

"Buffalo" Full Ball Bearing Single Suction Pumps are tops in efficiency with rock bottom maintenance costs. For the full story, call your "Buffalo" engineering representative or write for Bulletin 976-G.

Many Applications For "Buffalo" Single Suction Pumps:

- General water supply systems.
- Corrosive & non-corrosive liquids.
- Saturated liquids and refrigerants.
- Viscous fluids.

"Buffalo" PUMPS

BUFFALO PUMPS

Division of Buffalo Forge Co.

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A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

NEW

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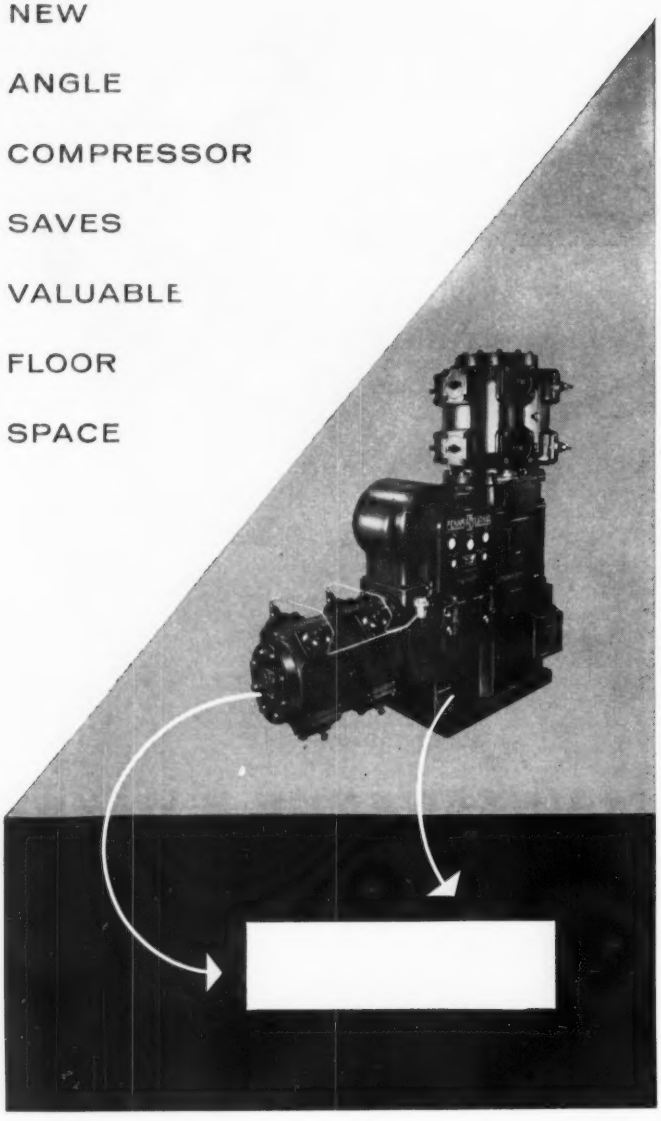
COMPRESSOR

SAVES

VALUABLE

FLOOR

SPACE



Look at all the space you save with the Pennsylvania HAE Angle Compressor. The 150 HP size, shown here, takes only 5' 5" x 7' 2" of floor space, including motor.

Now you can get efficient air service in a small space. It's the Pennsylvania HAE Angle Compressor—a dependable, two-stage, water-cooled double-acting compressor, built for continuous, heavy duty service. Designed with one vertical low pressure cylinder and one horizontal high pressure cylinder, it's compact, self-contained, pressure lubricated and ready to run when installed.

The HAE uses the same highly-efficient, trouble-free Air Cushion Valve found in all Pennsylvania Compressors. Its unique design eliminates use of bolts, nuts or screws likely to burn fast or work loose. Life is prolonged, maintenance diminished. For full information on Pennsylvania HAE Angle Compressors, write for your free copy of Bulletin 625.

PENNSYLVANIA PUMP AND COMPRESSOR CO.

EASTON, PA. • Earning customer confidence since 1920

Appointments

Corporation changes

Blaw-Knox Co, Power Piping Div: E S Wright, vice-president—general manager. **Fuller Co,** Dracco Div: H W Gaeckle, vice-president and general manager. **Lear, Inc:** A G Handschumacher, president. **Syntron Company:** B K Hartman, executive vice-president and general manager. **Orr & Sembower, Inc:** R C Currie, vice-president. **Rockbestos Wire & Cable Co:** E E Barth, treasurer.

Scovill Manufacturing Co: J J Hoben, vice-president and operations manager. **Seaboard Refractories Co:** D A Mitchell, president. **Stone & Webster Engineering Corp:** R S Boyd, J M Hamill, W S Roberts Jr — assistant vice-presidents. **Universal Silencer Co:** R L Hoyle, president; E S Stoddard, vice-president; E F Durava, secretary-treasurer.

Vitro Engineering Co: D M Checkley, president. **Wagner Electric Corp:** G W Brown, president. **Waltham Precision Instrument Co:** A C Bayle, vice-president of engineering.

Operations changes

Allis - Chalmers Manufacturing Co: N W Morelli, works manager; C R Gibbs, director of service, Industries Group. **American Pulley Co:** C E Bain, general works manager.

General Electric Company: Dr H R Schmidt, manager—chemical laboratory; J E Pitman, manager of product planning—Communication Products Dept. **New York Air Brake Company,** Aurora Pump Div: J M Bals, general manager. **Nuclear Science and Engineering Corp:** Dr R C Koch, assistant manager — chemistry dept. **Ohio Brass Company:** H J Clark, manager — valve dept. **Pacific Power & Light Co:** R R McLagan, superintendent—Portland power district. **Sargent & Lundy:** F W McCloska, nuclear projects head. **Westinghouse Electric Corporation,** Atomic Power Laboratory: P N Ross, general manager; H L Russo, Italian Atomic Project head.

continued

K&M ZEBRA

THE YEARS-AHEAD DEVELOPMENT IN PIPE INSULATION!

3 times faster to apply than 2-layer segmental insulation, new "K&M" ZEBRA is a multi-layer sectional-type thermal insulation for low, medium and high temperatures. And, it's as rugged as it is speedy. ZEBRA withstood repeated drops up to 8 inches without cracking... in increments of one inch. Bend it...and there's no cracking. (Its deflection at breaking point is 2 to 4 times that of ordinary insulation.) That's why breakage during installation practically disappears. There's a new ease of handling, too. No skin irritation. No skin penetration by ragged projections. "K&M" ZEBRA is smooth-surfaced. Get more information on this exciting, new development in pipe insulation. Write to us today for more information.

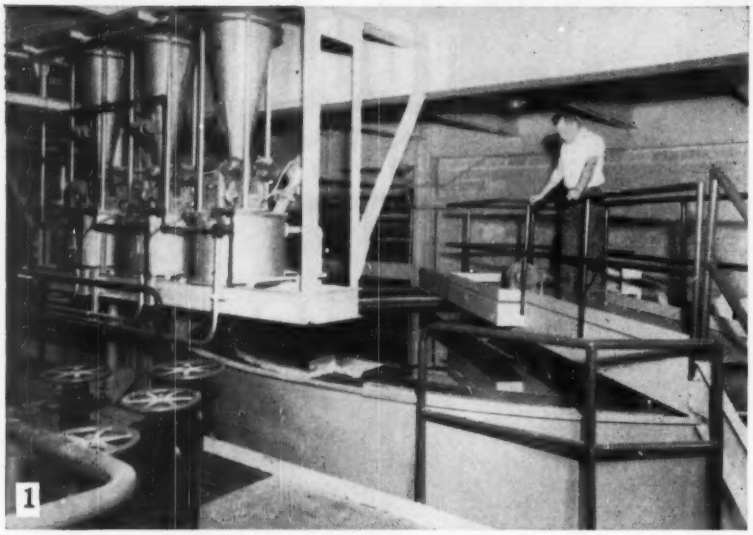
• For temperatures of 200°F. to 1200°F. • Withstands shock and heat without warping or cracking. • Made of calcium silicate—asbestos fiber bonded felts. • Can be re-used . . . can be dismantled and re-applied. • Available in wide range of sizes and thicknesses. • Tested by an independent testing laboratory.

K·M
BEST IN ASBESTOS

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

For more facts circle 321 on Reader Service card, p 101

FLUIDICS* AT WORK



How new McMeekin Station treats its boiler water

Raw lake water from Lake Murray is the source for boiler feed at the new Silas C. McMeekin Station of South Carolina Electric and Gas Co.

Here's what the water analysis looks like:

Silica	9.0 ppm
Iron	0.8 ppm
Turbidity	15.0 ppm
Colorants	35.0 ppm
Electrolytes	50.0 ppm

Hardly the sort of water you put in a boiler operating at 2450 psig. So you'll find a complete Permutit water treatment system at McMeekin Station. Gilbert Associates, Inc., Reading, Pa., consultants on this job, report current results from the equipment as follows:

1. Precipitator and chemical feeders lower iron to 0.2 ppm, turbidity to less than 5 ppm, colorants to 2 ppm.

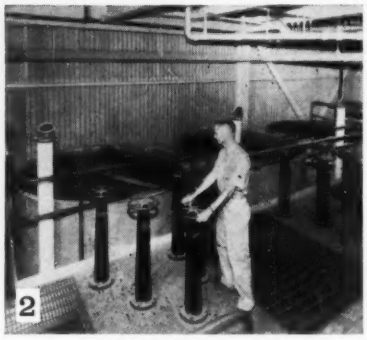
2. Three gravity filters further reduce turbidity to less than 1 ppm.

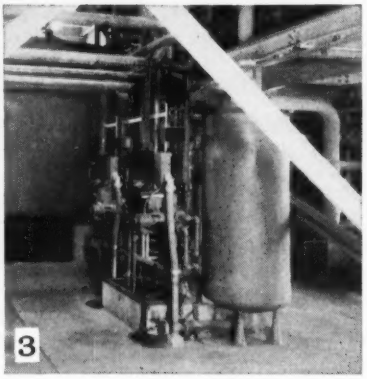
3. Complete demineralization plant, cation and anion exchangers lower the scale-forming silica to an inoffensive .02 ppm, electrolytes to .75 ppm.

4. Fully automatic Permutit control cubicle (not illustrated) remotely controls, monitors and records systems operation at all times.

Such complete water treatment is typical of a Permutit installation and of the all-round service you get from our FLUIDICS program. If you have a boiler feed water problem, for example, our Permutit Division can provide everything you require from initial survey to final equipment system.

For more information, write PERMUTIT, 50 West 44th Street, New York 36, N. Y., or call your local Permutit representative.





*FLUIDICS is a complete, imaginative Pfaudler Permutit program which economically provides practical answers to problems involving liquids and gases.

PFAUDLER PERMUTIT INC.

Specialists in FLUIDICS...the science of fluid processes

Appointments

Begins on page 170

Consultant changes

General Electric Company, Atomic Power Equipment Dept: R H Graham, product - planning consultant. **Gulton Industries, Inc:** Dr L A Pipes, consultant in systems engineering. **Henry J Kaiser Company,** Kaiser Engineers Div: W D Sinclair, power consultant. **Westinghouse Electric Corporation,** Steam Div: M A Nelson, engineering consultant.

General sales manager

Allis - Chalmers Manufacturing Co, Construction Machinery Div: V M Holloway, general sales manager; Defense Products Div: R R Walker, sales manager. **Boiler Engineering & Supply Co,** Continental Boiler Div: J A Hohenleitner, sales manager. **Combustion Engineering, Inc:** V P Owens, general sales manager in charge of industrial products. **Cooper - Bessemer Corp:** D L Reed, manager of packaged compressor sales. **Dayton Rubber Co:** A W Cox, director of urethane product sales. **H K Porter Company, Inc,** National Electric Div: G F Placier Jr, assistant sales manager; R Huckestein, product manager—underfloor raceways; W H Heer Jr, product manager—busways. **Kaiser Aluminum & Chemical Corp,** Electrical Conductor Div: R A Walker, sales manager.

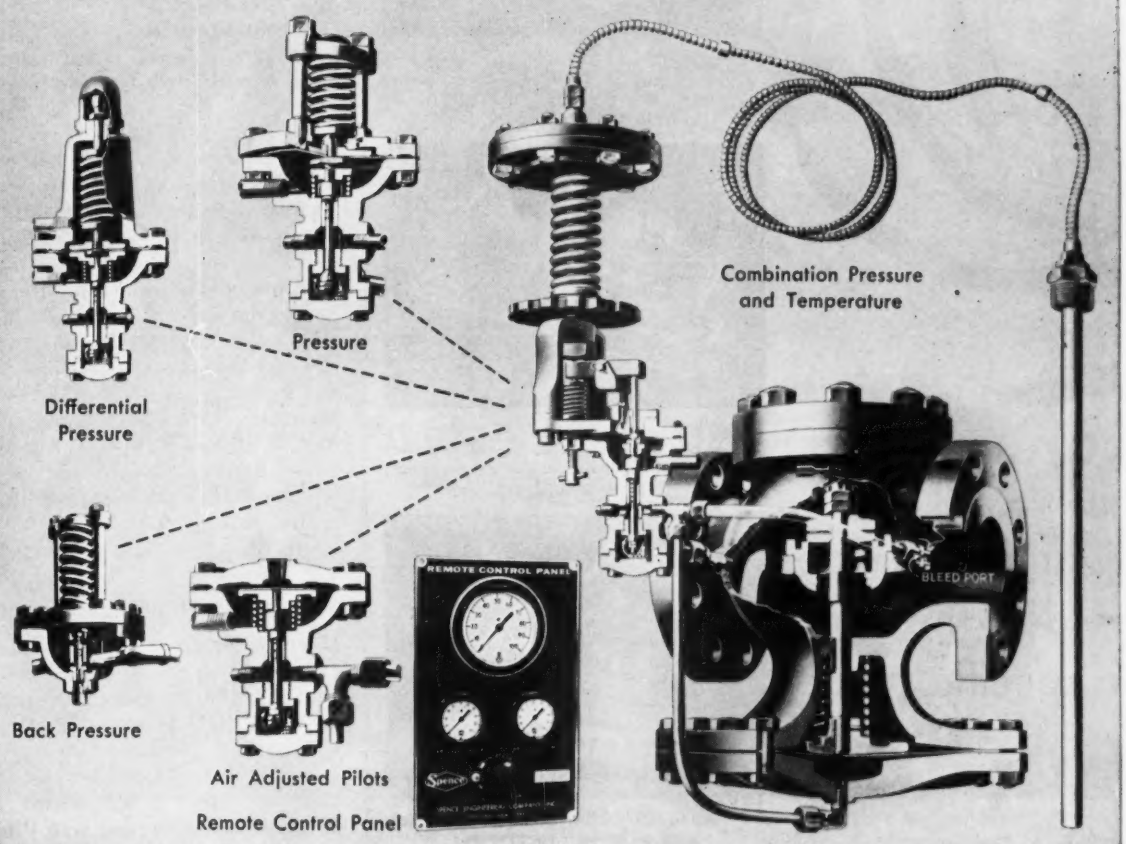
Norton Company, Electro-Chemical Div: E D Porter, manager of sales and technical services. **Seaboard Refractories Company:** Paul von Stein, technical sales manager. **Standard Wire & Cable Co:** L O Seerdon, general sales manager. **Stock Equipment Company:** C J Sted, sales manager. **Letourneau - Westinghouse Company:** D K Heiple, sales manager.

District sales managers

Allis-Chalmers Mfg Co: H S Sells, Boston; A R Knauss, Knoxville; A E Decker, eastern area of Defense Products Div. **American - Standard Corp,** Detroit Controls Div: S E Leinwand, eastern regional manager. **Babcock & Wilcox Co,** Tubular Products Div: T W Wright, assistant manager of New York area;

VALVE TIPS:

All Pilots Fit All Main Valve Sizes Downtime, Maintenance, Inventory Reduced



Let's start off by admitting there's no such thing as a "maintenance-free" regulating valve. Any valve that automatically controls temperatures or pressures within close limits can be affected by dirt in steam lines.

If trouble does develop, engineers want a regulator they can get back on the line — fast. That's one reason why more engineers are standardizing on Spence Regulating Valves with externally mounted pilots. The simple test of disconnecting the external bends establishes whether the trouble is in the main valve or the pilot.

If the main valve is the trouble spot, it can be maintained without removing the valve body from the line. If the pilot is the trouble spot, it is easily removed for cleaning. However, if production downtime is a strong factor, the fastest method is to install a spare pilot and it is inexpensive.

All Spence pilots fit all sizes of Spence main valves. If you have twenty pressure regulators, for instance, all you need is *one* spare pilot. It will fit all main valve sizes from ¼″ to 12″.

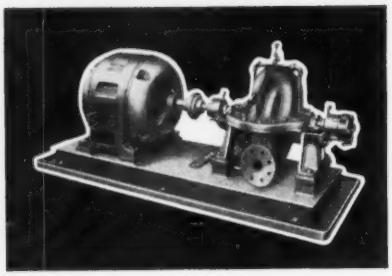
Another advantage of the Spence design is the external pilot is interchangeable. You can change the function of a regulator by merely changing the pilot. In many plants this can represent an important factor in reduced inventory costs because you only carry a few inexpensive extra pilots instead of complete regulators. Obviously, there is also a considerable savings in labor costs when a valve can be converted, in the line, from a temperature regulator to any one of various pressure regulators.

The pictures above show a few of Spence's wide line of automatic regulators. For more information write for Bulletin TE.

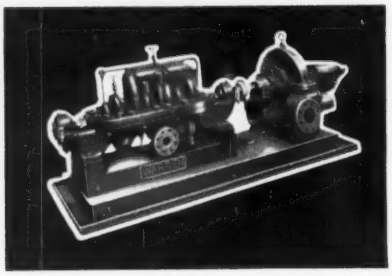
SPENCE ENGINEERING COMPANY, INC.
Walden, New York SE-145

WARREN BOILER FEED PUMPS

designed for RELIABILITY

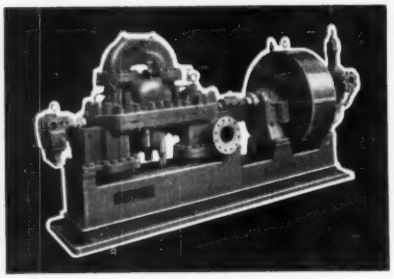


TYPE TL—
up to 400,000 lbs./hr. for 150 psi boilers
up to 400,000 lbs./hr. for 250 psi boilers
ASK FOR BULLETIN 246



TYPE TM—
up to 200,000 lbs./hr. for 400 psi boilers
up to 400,000 lbs./hr. for 600 psi boilers
ASK FOR BULLETIN 241

...and each type is designed for a specific range



TYPE TH—
up to 400,000 lbs./hr. for 900 psi boilers
ASK FOR BULLETIN 244

In the design, manufacture and test of all Warren pumps for Boiler Feed Service, *reliability* is the prime consideration. And when a pump is reliable, you can be sure it will have *low maintenance cost, long life* and *consistently high efficiency*.

Warren's use of modern hydraulic principles and mechanical features is also notable in *special designs* for such services as Low Submergence or High Speeds (over 3600 RPM).

CENTRIFUGAL · SCREW · RECIPROCATING · GEAR

WARREN PUMPS, INC.

WARREN, MASSACHUSETTS

P-38

For more facts circle 324 on Reader Service card, p 101

Appointments

Begins on page 170

R E Halloran, Pacific coast. **Cooper-Bessemer Corp:** D E Dixon, Houston office.

Daystrom, Inc, Daystrom-Weston Sales Div: R K Patterson, northwest district. **Ford, Bacon & Davis, Inc:** C G Whittelsey, Pacific coast. **H K Porter Company, Inc,** Delta-Star Electric Div: W McNulty Jr, Syracuse, New York; A D Sangdahl, Milwaukee office.

International Resistance Company: D V Jarvis, Chicago area. **I-T-E Circuit Breaker Company:** J E Bevan, New York; T D Williams, Minneapolis. **L J Wing Mfg Co:** J J Hayes, New York. **Letourneau-Westinghouse Company:** J E Sheets, Eastern area. **Link-Belt Company:** R G Bottorf, Colmar, Pa.

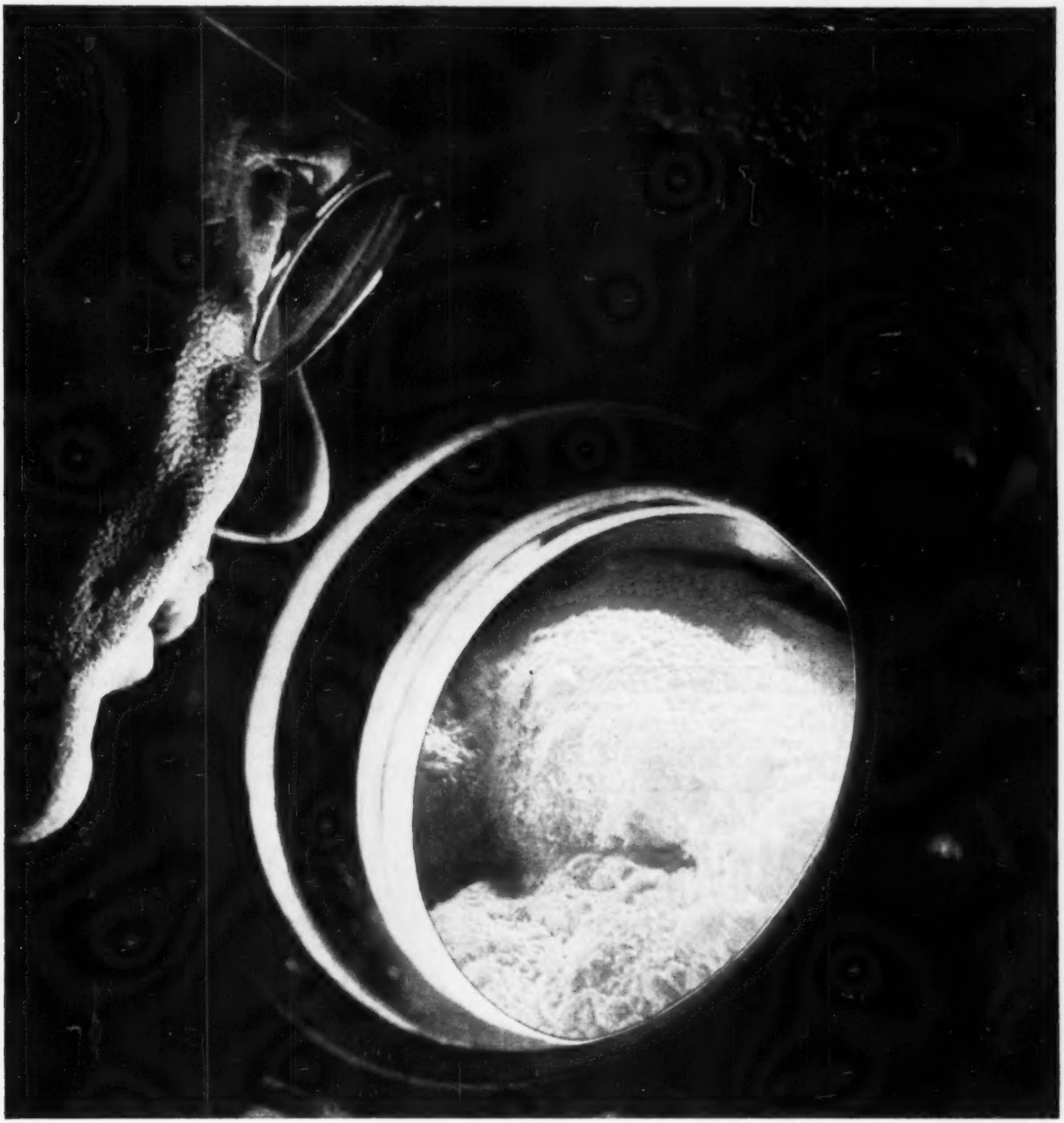
Minneapolis-Honeywell Regulator Company: R A Wolfe, Pittsburgh; E J Reulbach Jr, Albany; J H Toifel, Columbus. **OPW-Jordan:** R J Peters, Southeast and Mid-continent area. **R & J Dick Company, Inc:** R H Scobie, Middle Atlantic states. **Synthane Corp:** J F Lent, Western New York State. **United States Rubber Co:** R W Stambaugh, Eastern region.

New sales engineers

Bristol Company: J E Gabrielson, Salt Lake City. **C & D Batteries, Inc:** I T Bartlett. **Edward Valves, Inc:** K C Karg. **General Electric Company,** Computer Dept: H Weiss, manager of applications engineering. **Heyl & Patterson:** G W Vines, contracting engineer. **Photomation, Inc:** H G Mellen. **SKF Industries, Inc:** H D Hineman, field engineer.

Engineer changes

Allis-Chalmers Mfg Co: E J Wallner, engineer-in-charge of project section; steam turbine dept; M Healy, J H Noble, nuclear power dept; M DeArmond, D D Greenwell, R R Burke, R D Selby Jr, Z A Wachta—Power Equipment Div; F N Grasberger Jr, I J Niemkiewicz—Norwood Works; E A Bemis, R W Ellis, D B McFadden, D E Esplund—Industries Group; R M Bellesorte, F P



How to get a safer, clearer look inside at 500°F.

This peephole is giving you a look at what happens at 500°F.—through a PYREX brand Sight Glass. Even at high temperatures, you get a safer look, a *clear* look—because it's a *special* glass.

Glass that can stand up to abrasion, thermal or mechanical shock. Glass that can stand pressures up to 300 p.s.i. Glass that resists clouding and pitting from corrosives. Glass that stays transparent for a long service life.

You can use PYREX brand Sight Glasses to see into ovens, absorption columns, reaction kettles, furnaces, pressure vessels, evaporators, stills, or processing tanks. They're available in a range of sizes for all applications.

Ask your regular industrial supply dealer for more information—or write us for your copy of Bulletin EB-20. It gives complete specifications of PYREX brand Sight Glasses with mounting recommendations. Corning Glass Works, 11 Crystal Street, Corning, N. Y.

CORNING GLASS WORKS
CORNING MEANS RESEARCH IN GLASS

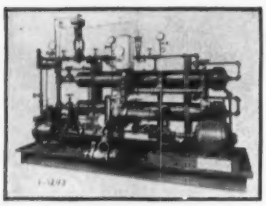
For more facts circle 325 on Reader Service card, p 101

Automatic
PACKAGED
FIRING UNITS
For Oil and/or Gas Fuels

• Fully Automatic • Low Fire Start • Electric-gas Ignition • Modulating Fire Control • Damper Sequence Control • Forced Draft Combustion Air • Electronic Combustion Safety Supervision • Mechanical Atomizing—Steam assisted internal mixing oil burner • Ring or Cylindrical type Gas Burner for gas fuel

For complete details, specifications, illustrations and dimensions write today for Bulletin No. 28.

by
NATIONAL AIROIL



FUEL OIL PUMPING AND HEATING UNITS

NATIONAL AIROIL makes a complete line of Fuel Oil Pumping and Heating Units for preparing heavy fuel oil for combustion for all types of Oil Burners. Illustrated is a compact, space saving Unit for 2000 Boiler H. P. installed in a large Meat Packing Plant.

Send for Bulletin No. 40 which illustrates and fully explains our wide variety of Pumping and Heating Units.

National Airoil
BURNER COMPANY, INC.
Main Office & Factory: 1250 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.
SOUTHWESTERN DIVISION 2512 SOUTH BOULEVARD, HOUSTON 6, TEXAS
INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT
For more facts circle 326 on Reader Service card, p 101

MOVING?
CHANGING ADDRESS?

Remember — it takes about a month to make the change, so YOU can help us give you better service. Send us the old addressing label AND your new address.

BE SURE TO INCLUDE THE ZONE NUMBER

Address:

Fulfillment Manager
POWER
330 West 42nd St.
New York 36, N. Y.

Appointments

Begins on page 170

Colon, J J Barton—pump department.

Bailey Meter Company: K R Dodson, resident engineer, Corpus Christi. **Norton Company:** T W Ekberg, W D Leetch Jr—refractories engineers. **Sterling Machinery Company,** Pump Div: D A Kaessen, chief design engineer.

New district offices

Clark Bros Co: Turbo Repair Facility, Beaumont, Texas. **Goulds Pumps, Inc:** 1007 Petroleum Tower, Shreveport, La. **Henry J Kaiser Co,** Kaiser Engineers Div: 228 North La Salle St, Chicago, Ill. **Republic Manufacturing Co:** 15844 Strathern St, Van Nuys, Calif.

Recent moves

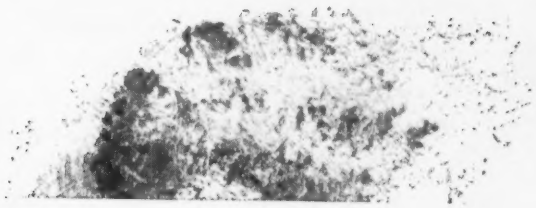
Cooling Tower Institute: administrative offices located at 1120 43rd St, Houston, Texas. **Farrel-Birmingham Company, Inc:** industrial-gear sales headquarters at 344 Vulcan St, Buffalo, N. Y. **Fostoria Corp,** Chempump Div: Buck and County Line Roads, Huntington Valley, Pa. **Buffalo-Eclipse Corp,** Penberthy Mfg Co Div: Prophetstown, Ill. **Thompson Ramo Wooldridge Inc,** Thompson-Ramo-Wooldridge Products Co: 202 North Canon Dr, Beverly Hills, Calif.

New names

Halex, Inc: a new corporation pioneering in the field of Molecular Electronics. **Insulation Information Center:** an advisory service on insulation characteristics, techniques and specifications established by NIMA. **NEMA Electrical Indicating Instrument Section:** industry section of National Electrical Manufacturers Association for manufacturers of electrical indicating instruments.

Secondary Recovery Engineering Corp: will evaluate and develop water-supply and waste-disposal systems for the electrical industry. **Sentry Equipment Corp:** will manufacture and distribute the complete line of Henszey power-plant equipment.

continued



Wiping out air-pollution problems...

a job for American-Standard Industrial Division

No two air-pollution problems are exactly alike.

We know this . . . because we've come to grips with problems of every description in designing equipment to meet specific requirements.

With a complete line of products for dust and fly-ash control – ranging from small, individual cyclone collectors to the most advanced electrostatic precipitators – we are equipped to put our knowledge into practice for you.

With offices in all principal cities staffed by product specialists – we are ready to serve you. Just call the one nearest you to discuss practical answers to your air-pollution problem.

• •

JUST OFF THE PRESS! New Bulletin No. 1828 contains complete data on American-Standard Series 342 Mechanical Collectors. Just write for your free copy . . . today!

• •

AMERICAN-STANDARD* INDUSTRIAL DIVISION, DETROIT 32, MICHIGAN. IN CANADA: AMERICAN-STANDARD PRODUCTS (CANADA) LIMITED, TORONTO, ONTARIO.

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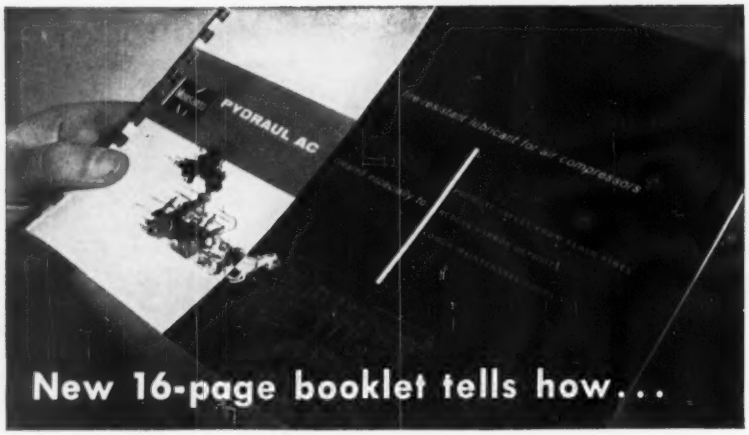
American-Standard PRODUCTS

AMERICAN-Standard

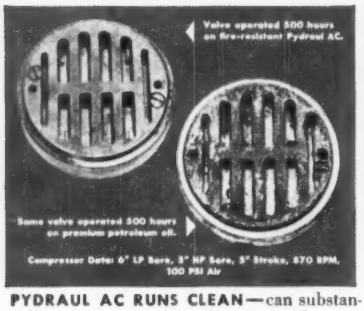
INDUSTRIAL DIVISION

AMERICAN BLOWER PRODUCTS • ROSS PRODUCTS • KEWANEE PRODUCTS

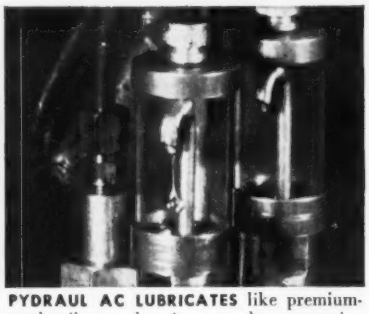
For more facts circle 328 on Reader Service card, p 101



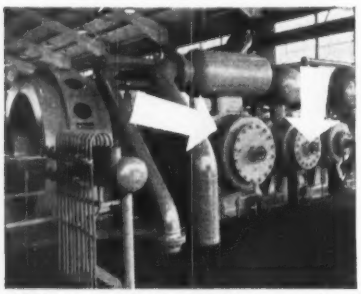
PYDRAUL AIR COMPRESSOR LUBRICANT GIVES 3 "MOST WANTED" BENEFITS AT LOWEST COST: LOW UPKEEP, PEAK LUBRICATION, FIRESAFETY


Valve operated 500 hours on fire-resistant Pydraul AC.
Same valve operated 500 hours on premium petroleum oil.
Compressor Data: 6" LP Bore, 5" HP Bore, 5" Stroke, 870 RPM, 100 PSI Air

PYDRAUL AC RUNS CLEAN—can substantially cut compressor upkeep costs because it reduces build-up of carbon and other deposits—extends time between overhauls. Side-by-side photos (above) of an exhaust valve—used in the same industrial air compressor with only the lubricant changed—show how Pydraul keeps systems freer from harmful and dangerous deposits than a premium oil. Lower maintenance costs alone usually justify use of Pydraul.



PYDRAUL AC LUBRICATES like premium-grade oil—good anti-wear and noncorrosive features give equipment long life. And Pydraul is the one lubricant for virtually every compressor you own—has demonstrated excellent lubricating efficiency in hundreds of compressors of all sizes produced by all major manufacturers—gives trouble-free compressor operation for many years. Now, Pydraul is effectively lubricating compressors operating at over 4500 psi.—many operating continually with exhaust air temperatures of 340°F.



FIRESAFE PYDRAUL AC GIVES protection 2 ways in this danger zone—guards these three 4,000-hp. compressors. Petroleum oil residues deposit inside cylinders, valves, piping—glow hot and flake off—can unpredictably ignite flammable vapors from hot petroleum-based lubricants, causing fire...explosion! Monsanto's synthetic lubricant, Pydraul AC, essentially eliminates this basic cause of most compressor fires and explosions: It lessens carbon deposits and oxidation residues, and it is *fire-resistant.*

PHOTO COURTESY GRACE CHEMICAL CO. DIV. OF W. R. GRACE & CO.

PYDRAUL—MONSANTO T. M. REG. U. S. PAT. OFF.

New, illustrated booklet gives more details, including how to make the easy conversion to Pydraul AC. Write, today. No salesman will call unless you so request.

Monsanto®

FOR CONVENIENCE, USE QUICK REPLY COUPON

Monsanto Chemical Company
Organic Chemicals Division
Dept. PO-1, St. Louis 66, Mo.

Please send me the new 16-page booklet on fire-resistant Pydraul AC lubricant for air compressors.

Name_____

Company_____

Address_____

City_____

Appointments

Begins on page 170

Recent purchases

American Machine and Metals, Inc has purchased the assets of **Automatic Devices Co, Inc** except for the company's plant. **Textron, Inc,** G-C Electronics Company Div has purchased **Electrocraft, Inc. Cerro de Pasco Corporation:** liquidation of **Rockbestos Products Corporation** and incorporation as Rockbestos Wire & Cable Co Div of Cerro de Pasco Corp.

Institute elections

National Association of Power Engineers, Inc: H H Foreman, national president. **Illuminating Engineering Society:** J B Browder, president.

Awards

Dr Clarence Zener, director of the Westinghouse research laboratories in Pittsburgh, received a John Price Wetherill Medal from the Franklin Institute for his contributions to the field of solid-state physics.

Samuel Glasstone, consultant to the Los Alamos Scientific Laboratory, is to receive the Worcester Reed Warner Medal for his contribution to the permanent literature of engineering.

Retirements

Calvin T Hughes, vice-president and consulting engineer of The Connecticut Light and Power Company, after more than 40 years. **John H Kuhns,** manager of the New York district office of I-T-E Circuit Breaker.

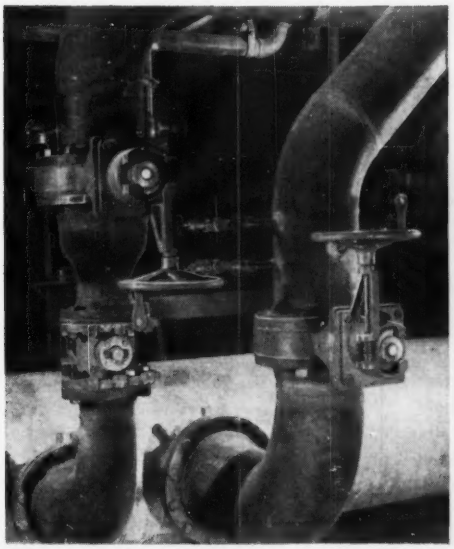
Obituaries

James Coleman, planning and services manager for Amperex Electronic Corporation.

Alfred Kauffman, former president of Link-Belt Company, on August 7.

Theodore R Roberts, valve department manager for Ohio Brass Company, on August 2.

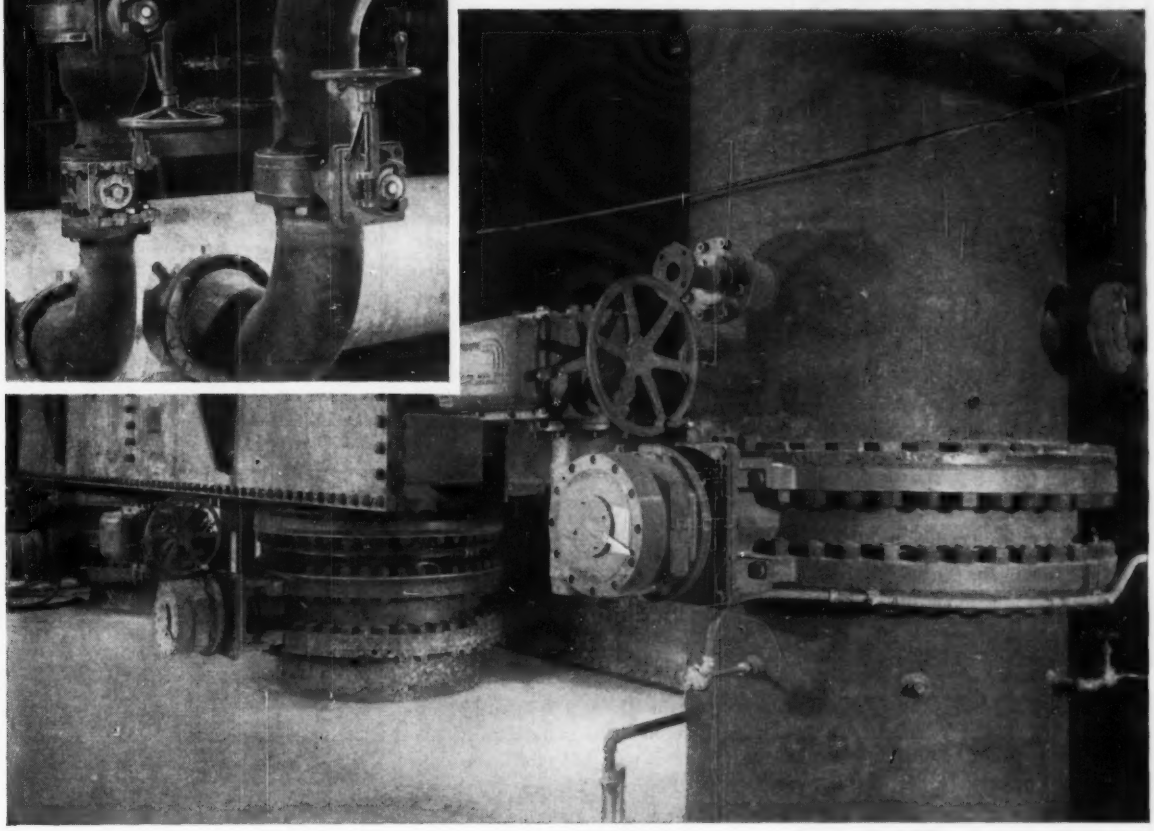
Joseph Harrington, inventor and director of Illinois fuel conservation programs during both world wars, on September 7.



LEFT—Full-bodied design of these A-C wafer valves eliminates cracking around the bolt holes even under the most rugged service conditions.

BELOW—Wedging action of the vane against the tough, flexible rubber seat in these A-C butterfly valves assures positive closure, even around the shaft bosses.

Engineered and constructed by Stone & Webster



New Potomac Electric Generating Station Installs 65 ALLIS-CHALMERS Rubber-Seated Butterfly Valves

On the cooling water systems for Units 1 and 2 at Potomac Electric Power Company's new generating station in Dickerson, Md., 65 Allis-Chalmers rubber-seated butterfly valves, in sizes from 6 to 72 inches, have been installed. 41 of these are the new, full-bodied A-C wafer valves, which are now finding wide use in locations where older, non-rotary type valves had previously been applied.

The through-type rubber seat in A-C butterfly valves helps assure trouble-free operation with few maintenance problems. By covering the entire inner body, it gives complete internal protection, eliminates tuberculation and oxidation. A-C rubber-seated valves are easy to operate, will provide 100% effective shutoff with a 125-pound pressure drop. Angle-seated vanes can be adjusted by resetting the operator stops.

You can obtain complete information on power plant applications for the full Allis-Chalmers line of butterfly, ROTOVALVE and ball valve units by contacting your A-C Valve Representative, or by writing Allis-Chalmers, Hydraulic Division, York, Pennsylvania.

ROTOVALVE is an Allis-Chalmers trademark.

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Bookshelf

Metallizing Handbook. *345 pp, Cloth, $5.00. Metallizing Engineering Co, Inc, 1101 Prospect Ave, Westbury, Long Island, N. Y.* Modern metal and ceramic flame-spraying are featured in this reference. Book is useful for anyone concerned with machine maintenance and the protection of iron and steel structures and exposed equipment. Supplemented with over 150 diagrams, charts and photographs, handbook goes into the latest development in spraying of hard-facing alloys including tungsten carbide.

Tabulated engineering data is provided on physical properties of sprayed metals, spraying speeds and other important coating characteristics. An entire chapter is devoted to powder spraying.

Design of Industrial Exhaust Systems, 3rd Ed. *By J L Alden. Indexed, 256 pp, 137 illust, 6x9, cloth, $6.00. The Industrial Press, 93 Worth St, New York 13, N. Y.* This text has been a standard reference in its field for more than twenty years and is now brought up to date with a treatment of fog filters, reverse-flow filters, venturi scrubbers and multiple miniature cyclones. The flavor and clarity of the original text reflects author's long association with industrial ventilation. Book is practical, but includes an impressive array of formulas, tables, footnotes, and references.

Subjects covered include fluid flow, hoods of all types with their characteristics and specifications for various operations, duct (piping) system design, dust separators with characteristics of various types, pneumatic conveyors, fans, system detail and planning, field measurements and their interpretation.

Nondestructive Testing Handbook. *Edited by R C McMaster, 2 vol, $24.00. Ronald Press Company, 15 E 26th St, New York 10, N. Y.* Prepared under the auspices of the Society for Nondestructive Testing, this handbook draws together information from significant and widely scattered sources. Professional journals, society proceedings, com-

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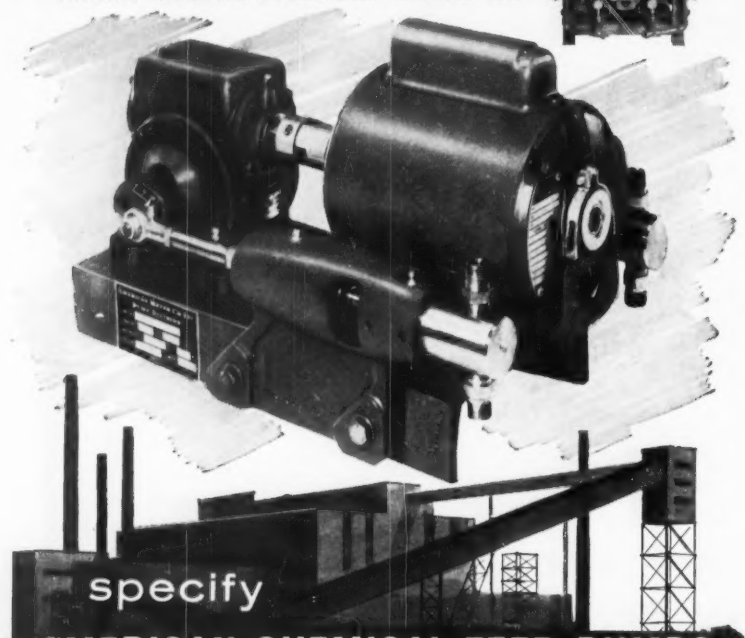

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Bookshelf

Begins on page 180

mittee reports, standard books, company research, operating data, records, reports of designers and users of testing equipment are some of the sources used. A board of 106 editors contributed to the book's makeup.

Handbook intends to integrate the experience acquired throughout industry to date in selecting, applying and interpreting tests designed to improve performance reliability of equipment, to cut costs, insure product quality or uniformity and increase the utilization of materials, reducing breakdowns and accidents.

Organized into 54 coordinated sections, the handbook is a working guide for improving industrial processes. Over 1200 charts, drawings and photographs are included along with data in graphic and tabular form.

Soviet Reviews of Nuclear Science. *110 pp, illust, $5.00. Pergamon Press, 122 E 55th St, New York 22, N. Y.*

This volume is a translation of articles written by leading Soviet scientists published in the *Journal Atomnaya Energiya* to commemorate the 40th Anniversary of the Revolution of 1917. They present an authoritative account of recent developments in the field of nuclear energy in the Soviet Union.

Table of contents includes the development of atomic energy in the Soviet Union, the uranium-graphite reactor and superheated steam-power stations, efficiency of atomic-power stations, high-energy research with the Synchrocyclotron of the Laboratory of Nuclear Problems at the Joint Institute of Nuclear Studies, interaction of slow neutrons with nuclei, use of radioisotopes in the USSR and Soviet radiochemistry.

Heating Handbook. *$1.00. Dunham-Bush, Inc, West Hartford, Conn.*

Reprinted recently, this pocket manual is handy both for consulting engineers and engineering schools. Sections on wet heating systems, radiation, unit heaters, pumps, control equipment, engineered radiation, blower unit heaters, special-purpose pumps and related products are included with engineering data.

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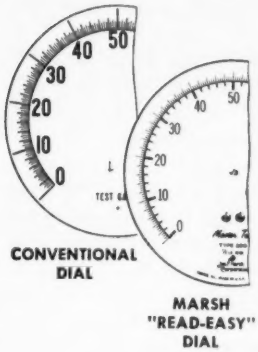
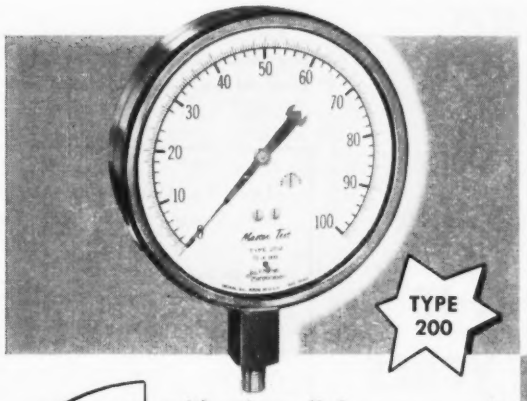


Crowning achievement in instrument making... this superb series of test gauges developed to meet today's exacting requirements of instrument men throughout industry. Accuracy and dependability beyond compare...each gauge individually dead-weight tested (think what that means!)...each gauge guaranteed accurate within ¼ of 1% plus or minus of the maximum dial reading over the entire range.

To provide reading accuracy in keeping with the accuracy of the instrument, all "Master-test" gauges have the simplified "Read-easy" dial (patent pending) illustrated opposite—a dial that can be read with the accuracy of a caliper, yet with the ease of a clock.

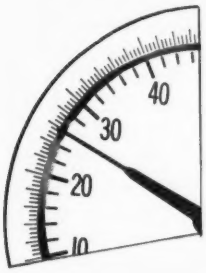
To further increase accuracy, three advanced means of reading have been developed as described below: the "twin-tip" pointer; the mirror path; the non-parallax dial.

"Master-test" gauges are available in sizes 4½", 6", 8"...in all standard ranges from 0-15 to 0-30,000 psi...in vacuum and compound types...in a full range of case patterns. Ask for 20 page bulletin.



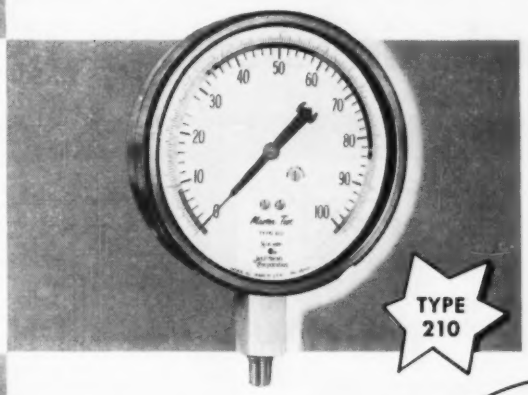
← with "Twin-tip" pointer

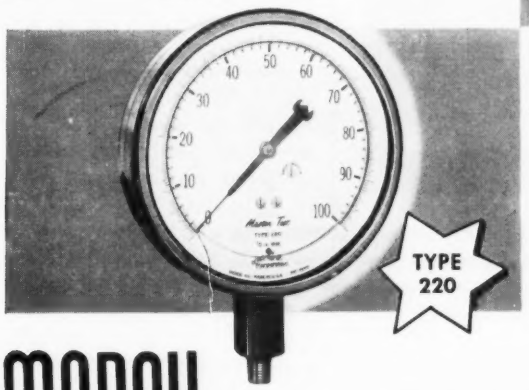
The most common error in reading pressure occurs when the observer reads from an angle rather than "dead on". This Marsh "Twin-tip" pointer enables the operator to know when he is dead on by lining up the two tips so that only one is visible. The twin-point arrangement is similar to the sights on a rifle.



with mirror dial →

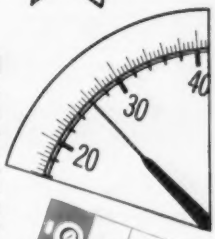
Another method of insuring accurate "dead on" reading. Knife edge pointer is reflected by the mirror path. When reflection is not seen, reading is dead on and true. The ease and accuracy with which the mirror dial may be read cannot be duplicated by any other mirror type dial. It is the combining of the mirror path with the exclusive Marsh "Read-easy" dial that makes this faster, error-free reading possible.





← with "Non-parallax" dial

This Marsh development eliminates mistakes in dial reading even if read at an angle. To accomplish it Marsh engineers designed a clear Plexiglas insert placed, as shown, over the fine graduations so that they appear to be at the same level as the pointer regardless of the viewing angle. The "Non-parallax" dial provides the easiest and most accurate dial reading available.



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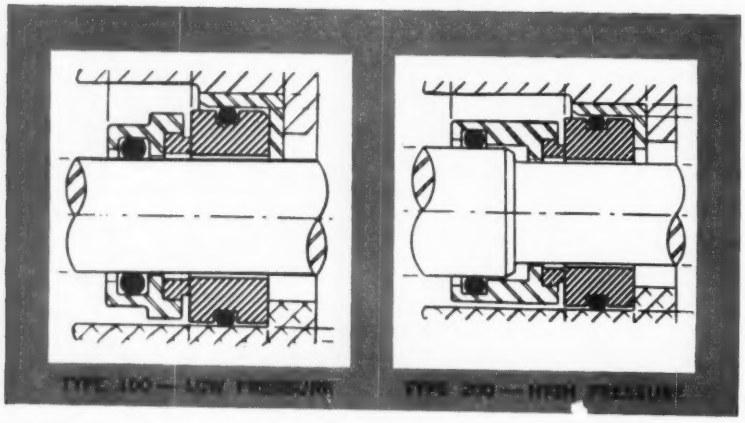

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Bookshelf

Begins on page 180

Internal Combustion Engines. *By Cdr P W Gill, USN, Cdr J H Smith Jr, USN, and Assoc Prof E J Ziurys, U.S. Naval Academy. 566 pp, illust, $5.00. U.S. Naval Institute, Annapolis, Maryland.*

The entire field of internal-combustion engines is covered from the basic theory and fundamental cycles through gas turbines, nuclear propulsion and rockets. Book was prepared primarily as a text for the U.S. Naval Academy and discusses general nomenclature, capabilities, and limitations of the various engine types.

Each chapter includes a bibliography and a set of questions for review of the subject matter covered.

How To Cut Your Insurance Costs. *$1.00. American Mutual Liability Insurance Company, Wakefield, Mass.*

A conference between editors of McGraw-Hill publications and insurance specialists from American Mutual, Mutual Boiler & Machinery Insurance Company and the Associated Factory Mutual Insurance Companies outlined ways and means for reducing insurance costs. The conclusions are recorded in this book. Reducing insurance premiums by taking specific precautions against hazards in manufacturing plants is the main topic.

Search for new uses for Austrian lignitic and sub-bituminous coal may see future gassification of coal.

Canada will build a low-power nuclear reactor designed to test uranium fuels for large electricity-producing atomic-power plants.

Coal surplus in 6-nation European Community, improved free-world oil outlook may reduce Euratom Commission's previous target of 15-million-kw nuclear generating capacity by 1967.

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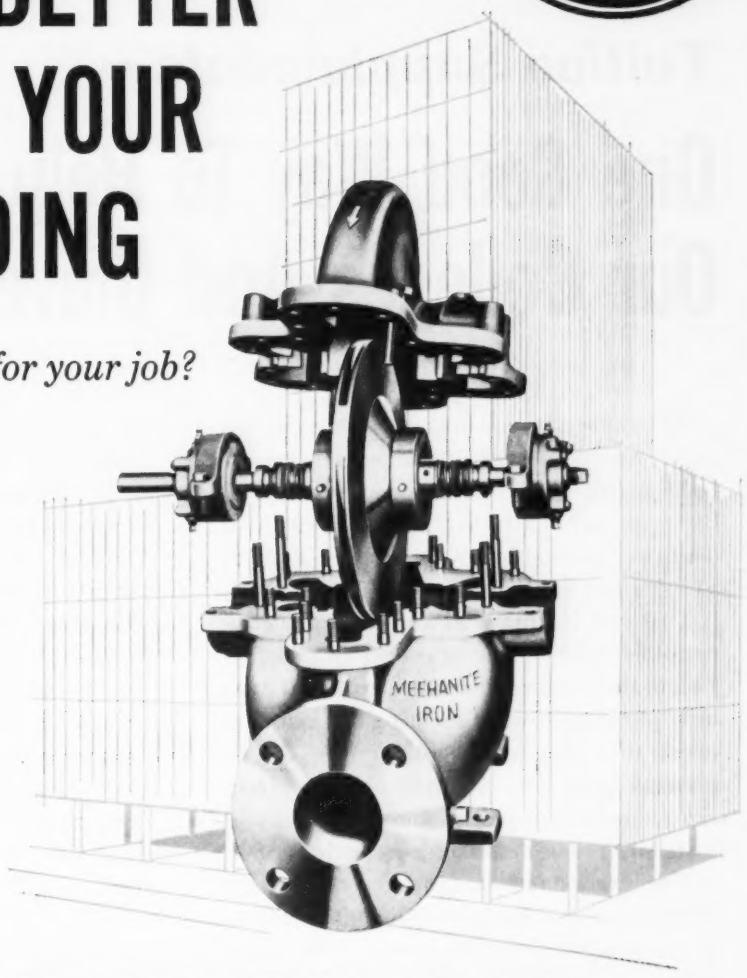

Fast, Easy Installation—Peerless AquaLine pumps install quickly in new or existing systems. No special tools are required. Take it out of the package and put it to work.

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AquaLine Characteristics:

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POW

For more facts circle 338 on Reader Service card, p 101

Tuition Supplements—

One Good Way To Help Our Colleges And Universities

The business community has made an impressive start in going to the desperately needed financial aid of our colleges and universities. Business contributions to higher education have increased from only $40 million in 1950 to $136 million in 1958.

This rise in financial aid to higher education should be a great source of satisfaction to the business community. But it goes only part way toward meeting the growing needs of colleges and universities for financial help. Over the next ten years business aid to our privately supported colleges and universities alone must increase to at least $500 million a year merely to provide decent faculty salaries and meet the increased operating costs of taking care of enrollments that will almost double.

One pervasive reason why many business firms have not joined the ranks of the companies contributing to higher education seems to be that, in the interest of prestige and public relations, they are making their provision of aid contingent upon finding some particularly novel way of providing it. So long as this point of view persists, business aid will lag, for there are simply not enough ways of providing financial aid that are both notably novel and sensible.*

How The Plan Works

There are, however, some well-tested ways of providing aid which improve rather than fade in appeal with more using. One such way is the making of supplemental tuition payments to colleges and universities at which a company's employees take courses.

Many companies have scholarship or tuition-refund programs which cover all or part of the costs to their *employees* of taking college courses. But, in most colleges and universities, tuition charges fall far short of covering the full cost of the education given. By making an unrestricted "cost-of-education" grant a part of their employee scholarship or tuition-refund plans, these companies could make a material contribution toward covering the *college's* full costs as well.

The tuition supplement can be a fixed amount or a percentage of the tuition charged. Some plans provide for supplements as high as 100% of tuition, though there is usually an upper limit to the total supplemental payment given for each employee enrolled in the institution.

The plan seems to have originated with the Ford Motor Company Fund. When we at McGraw-Hill first learned of it, it appealed to us as having so many advantages, and so few disadvantages, that we adopted it as one part of our own program of financial aid.

---

*The efforts of the McGraw-Hill Publishing Company to find a suitable method of aiding higher education prompted the writing of a "more or less Socratic dialog" entitled *A Business Wrestling with the Problem of Aid to Colleges and Universities*. Copies of this pamphlet, which underlines the difficulty of finding both a novel and satisfactory method of providing aid, are available on request.

HOW THE HEADS OF SOME OF THE INSTITUTIONS TO WHICH McGRAW-HILL HAS MADE GRANTS FEEL ABOUT THE TUITION SUPPLEMENT PLAN

"We are pleased not only because this addition to the never adequate supply of non-earmarked funds is a most welcome one, but also because it attests to the fact that the employees of our neighboring business firms are benefiting from the courses we offer at times convenient for them. We hope this mutually beneficial plan may continue and grow with the years."

Grayson Kirk, President
Columbia University

"I shall take this occasion to express deep sentiments of appreciation, in my own name and in the name of the members of the Board of Trustees, for the very effective manner in which your corporation is aiding higher education by the payments made under your tuition supplement plan. Certainly your action is indicative of the fact that you realize industry and higher education must join forces to preserve the basic American system of free enterprise."

Very Reverend John A. Flynn, C.M.
President, St. John's University

"The growing recognition by business and industry of the financial needs and important services rendered to the community by the colleges and universities is most encouraging, and Temple University is deeply appreciative of the fine support extended through McGraw-Hill's program of supplementary grants."

Robert L. Johnson, President
Temple University

The Plan's Advantages

The main advantages of the tuition supplement plan are:

- **It is simple and easily administered.** Payments can be made when scholarships or tuition refunds are granted, or at another time convenient to the company.
- **It relieves the company of the difficult and sometimes disagreeable task of choosing one college rather than another.** The individual employee makes the choice.
- **It directly serves the interest of the company by encouraging and aiding the institutions where its employees take courses.** In a sense, the company makes contributions in direct proportion to the value it receives in education for its employees.
- **It directly serves the interest of the colleges and universities receiving the grants by getting money to them in the form most appreciated**—unrestricted funds to be used at the discretion of their administrators.

Largely because tuition supplements are unrestricted as to use, this plan enjoys the unqualified approval and gratitude of the schools receiving such aid. This is not true of some of the other plans for granting aid to colleges and universities.

Tuition supplements, of course, can't be regarded as large efforts relative to the need of higher education and the responsibilities of business. But they are a very practical and useful first step, involving almost no problems. If you are not familiar with the idea of supplemental grants, why not discuss it with some of your friends in the field of higher education?

The Price Of Novelty

Our experience with tuition supplements indicates that this is an excellent plan, and we are glad to recommend it to other companies looking for an effective method of providing financial aid to higher education.

At any rate, we hope that business firms will not postpone granting financial aid until they find some novel way of doing it. If they do, it will be another case of too little and too late.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw
PRESIDENT
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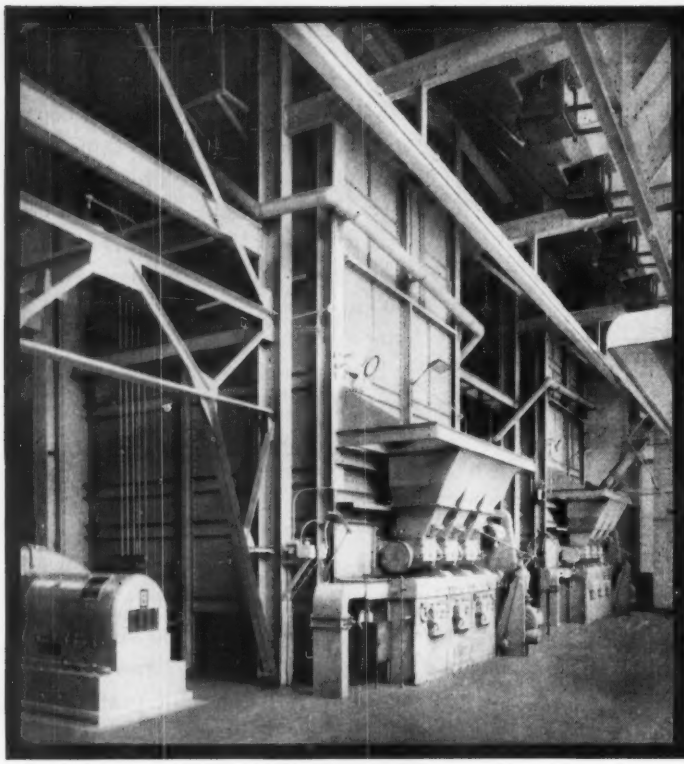
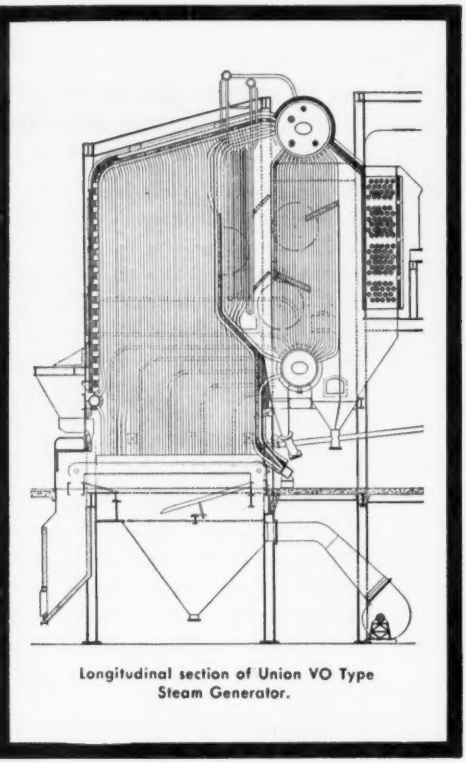




Longitudinal section of Union VO Type Steam Generator.

Union Boilers score new high at Notre Dame with 83% efficiency

Spread over a 1700-acre campus near South Bend, the University of Notre Dame is a self-sustaining community of 6,000 students and 500 faculty members.

To meet the demands of increasing enrollments, as well as to handle its own power requirements, the University expanded its steam heating plant and converted it to a steam-electric power plant. Three of the four original boilers were replaced with a pair of Union 2-drum VO Type Steam Generators. Spreader-stoker fired, each unit is equipped with a superheater and an economizer. Normal rating is 70,000 lbs./hr. at 470 psi and 750° F.

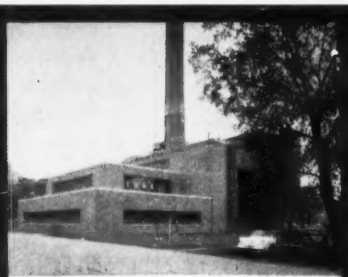
Although the heating load is increased 20%, and electric power is now supplied for all 75 buildings on the campus, boiler efficiency has been upped from 68% to more than 83%. *Coal consumption remains unchanged!*

This is just one job report where Union efficiency and dependability have achieved top-notch economy of operation. Across the nation, Union Boilers are giving similar service to industrial, institutional and public power plants, providing day-in and day-out, the best performance value in modern steam generating equipment.

GET FULL DETAILS

Information on the several types of steam generators built by Union is yours for the asking. Write for illustrated Catalog GB-153.

Aerial view of Notre Dame — with 75 buildings on a 1700-acre tract, this campus is a city in itself.



Steam-electric power plant makes campus community independent of outside power sources.

UNION

UNION IRON WORKS

ERIE, PENNSYLVANIA

For more facts circle 340 on Reader Service card, p 101

POWER POINTERS

257,500,000,000,000 BTUs

SINCE INSTALLING ONE OF THE COUNTRY'S FIRST HIGH PRESSURE FEEDWATER HEATER SYSTEMS, AN EASTERN POWER PLANT HAS CONVERTED OVER 10¼ MILLION TONS OF COAL INTO BTU'S. YET NOT A SINGLE MONEL TUBE IN ANY OF THE HEATERS HAS BEEN REPLACED. HEATERS OPERATE AT 2000 PSI WATER PRESSURE, USE STEAM AT 900°F STRONG MONEL* NICKEL-COPPER ALLOY RESISTS CORROSION, PERMITS USE OF RELATIVELY THIN-WALLED TUBING FOR MAXIMUM HEAT EXCHANGE.

¼ billion flexures in chlorinated water

...Monel check valve springs still springy

IN 1932, 3,450 MONEL CHECK VALVE SPRINGS WERE INSTALLED IN A METROPOLITAN WATER PLANT'S FOUR LARGE PUMPS. PREVIOUSLY, STRESS-CORROSION BECAUSE OF CHLORINE IN THE WATER CAUSED CRACKING AND FAILURE OF SPRINGS, SHORTENED THEIR LIFE TO 3 YEARS OR LESS. TODAY, OVER 90% OF THE ORIGINAL MONEL SPRINGS ARE STILL IN SERVICE, MANY AFTER 25 YEARS AND OVER A QUARTER BILLION FLEXURES.

The metal that comes back from Davy Jones' locker

MONEL ALLOY TAGS CLIPPED TO PUPS' FLIPPERS COME BACK FROM THE DEEP TO TELL A TALE OF THE MIGRATIONS OF SEAL HERDS. THE U.S. FISH AND WILDLIFE SERVICE FINDS MONEL ALLOY RETAINS IDENTIFYING MARKS FOR AS LONG AS 12 YEARS DESPITE SALT-WATER CORROSION AND ABRASION FROM ROCKS AND SAND.

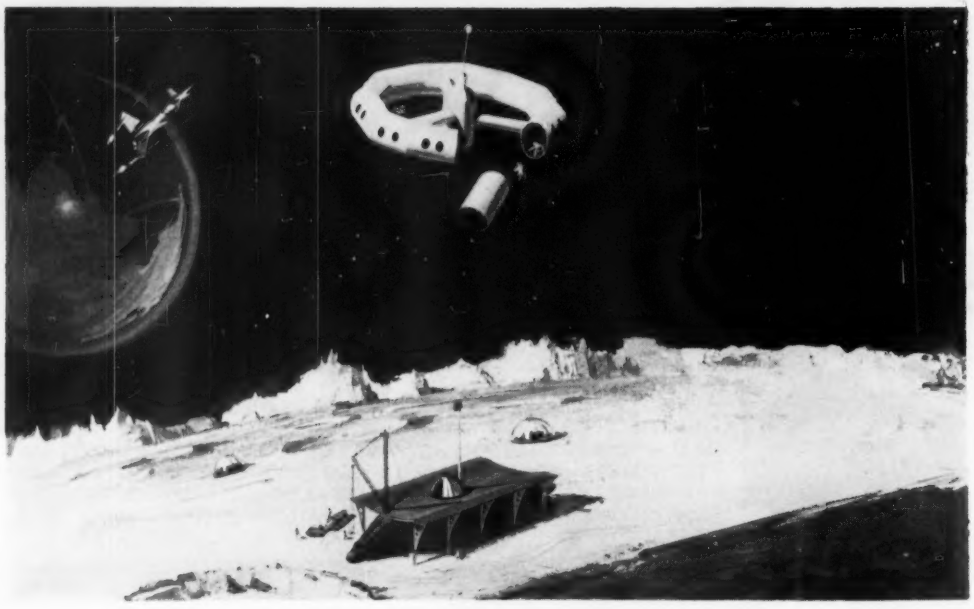
Slowed down by a metal problem?

A TALK WITH OUR ENGINEERS MAY HELP YOU GET BACK ON SCHEDULE. JUST GET IN TOUCH WITH US AND OUTLINE THE DETAILS. AND FOR A USEFUL RUN-DOWN ON MONEL ALLOY, WRITE FOR 30-PAGE BULLETIN, "ENGINEERING PROPERTIES OF MONEL AND 'R' MONEL ALLOYS".

*Trade mark

HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

MONEL®



George Edwards

Asks: Will there be space for *you* tomorrow?

Many of you probably have seen the above illustration before this. Used with a Republic Aviation ad it included a "timetable for space conquest":

By 1963—instrumented planetary soft landing
By 1968—space station for staging to moon and planets
By 1970—moon base

Alexander Kartveli, Republic Aviation's vice-president for Research and Development, made these predictions and is convinced, as are many other top-flight engineers and scientists, that this timetable is entirely feasible.

A few short years ago this was Buck Rogers stuff to us. Pure science-fiction. We'd admire the writer's fantastic imagination, enjoy reading the stories, then promptly forget them.

Today this is science, but not fiction. Imaginative, but not fantastic. It'll be reality tomorrow. We have read so much about living in the "jet age" that we're prone to accept it as up-to-the-minute. But we're moving from jet to space age faster than we realize. Reminds me of a cartoon I saw recently. Fellow in a control tower is talking to a test pilot aloft in a needle-nosed stub-winged vicious-looking fighter. "Might as well bring it down," he says, "it's obsolete already."

In our power-plant world, we're as concerned with the space age as are the guys who push the "fire" button on an ICBM. Without our power plants there'd be no missile, nor a firing button.

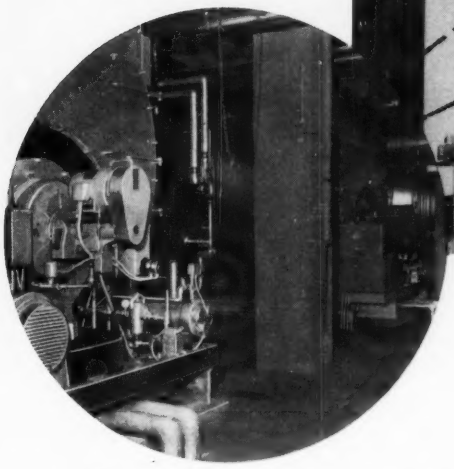
We know that a wheel's rim speed is greater in feet per minute than that of the driving shaft's periphery. But ratio between shaft and wheel speeds is a constant. If we want a high rim speed we've got to come up with the right shaft rpm.

Our power plants make up the shaft that drives our space-age wheel. Every ounce of "hardware" in today's "magic kitchen," automobile, nuclear reactor or earth satellite traces its present form to production equipment that is heated, cooled or driven by energy delivered from our power plants.

Since our space-age wheel's speed must depend on shaft rpm supplied by our power plants, what a challenge—and an opportunity—this gives the young engineer and what a market potential for his plant's top management. But, as with any opportunity, it'll pay off only to those prepared to meet the challenge.

Lou Rowley's editorial, *Think ahead—or pay the price* (Feb 1958, p 67) spells out what today's fast-moving pace means to the individual engineer. As for what it means to top management, I think Lou's editorial, *Plant Design: 1959,* in last month's POWER makes it crystal clear.

Where the *steam* comes from



...for Mutual Benefit Life's fine new buildings in Newark, N. J.

Complete firing system in one package. Every factor that affects firing efficiency is engineered into the unit at the factory. The unit includes: (1) Single or dual-fuel burner, with complete fuel handling systems. (2) Forced draft air supply. (3) Enclosed control panel, with instruments mounted, factory wired and tested, and with signal lights and gauges that afford a complete reading at a glance. In the oil-gas units, fuels can be switched automatically, or with the simple flick of a switch.

Fire low cost residual oils

The heavy residual fuel oils (No. 5 and 6) have higher heat value than light heating oils, yet cost less per gallon.

The Iron Fireman boiler-burner units shown here fire these sluggish oils with complete dependability. They protect against fuel emergencies because they can fire *any* grade of oil, light or heavy.

Gas or oil—switch fuels instantly

Dual-fuel models fire either gas or oil, and can be switched either by manual or automatic controls. In some areas gas rates are substantially less for customers whose steam plants switch automatically from gas to oil firing when outdoor temperature falls below a certain level, relieving the load on main gas lines when demand is highest.

Fires all types of boilers

Iron Fireman residual oil firing (with or without gas) is available in complete boiler-burner units ready for service connections, or as a package firing system that can be applied to any type of boiler.

Send coupon for further information

IRON FIREMAN®

AUTOMATIC FIRING EQUIPMENT

FOR OIL - GAS - COAL

IRON FIREMAN MANUFACTURING COMPANY
3134 West 106th Street, Cleveland 11, Ohio
(In Canada, 80 Ward Street, Toronto, Ontario)

Please send information on Iron Fireman forced draft firing for oil, gas or oil-gas combination.

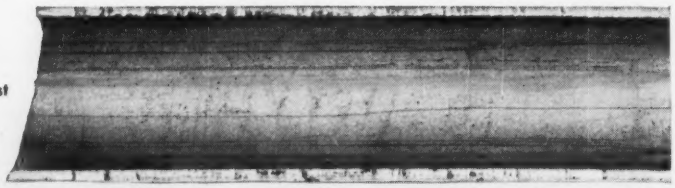
Name_____

Address_____

City_____ State_____

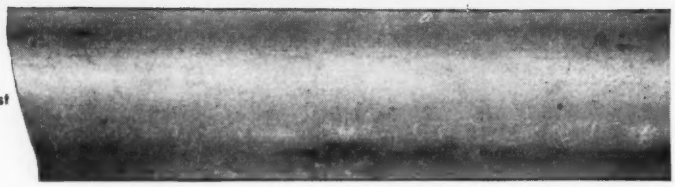
For more facts circle 342 on Reader Service card, p 101

Inside surface of Carpenter Stainless Tube after test



Carpenter stainless condenser tubes score impressive win in 8700-hour run

Outside surface of Carpenter Stainless Tube after test



To determine the suitability of various materials for retubing its surface condensers, a large Eastern power company subjected Carpenter Stainless Tubes to an actual service test of 8700 hours. When removed for checking their performance, the tubes showed no ill-effects from this punishing test. Not the slightest trace of corrosion or scale was visible on their inside or outside surfaces (shown above).

Evidence is piling up around the power industry in favor of Carpenter Stainless Tubes for condenser service, especially in brackish, highly acidic and other low pH cooling water conditions.

COOLING WATER

pH	6.7 — 7.5
Chlorides	1,500 — 15,000 ppm
Sulfate	400 — 2,000 ppm
Magnesium	300 — 1,000 ppm
Calcium	100 — 350 ppm
Bicarbonate	100 — 150 ppm
Suspended Matter	500 — 2,500 ppm
Total Solids	20,000 — 28,000 ppm
Oxygen	1 — 8 ppm
Sulphides and Sulphates	Indeterminate but present

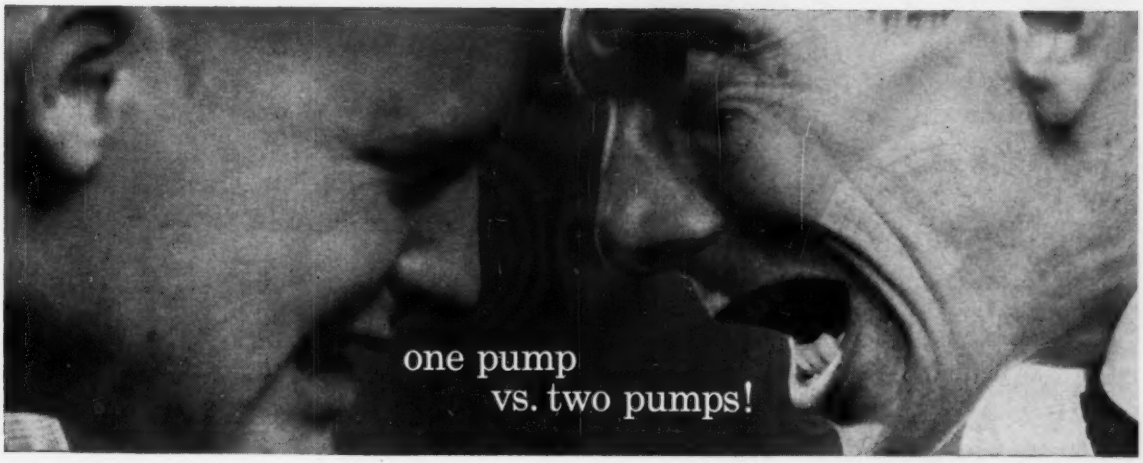
Take advantage of Carpenter experience, know-how and cost-savings on your condenser tube problems. Contact our nearest office for technical assistance and helpful engineering data. The Carpenter Steel Company, Alloy Tube Division, Union, N. J.

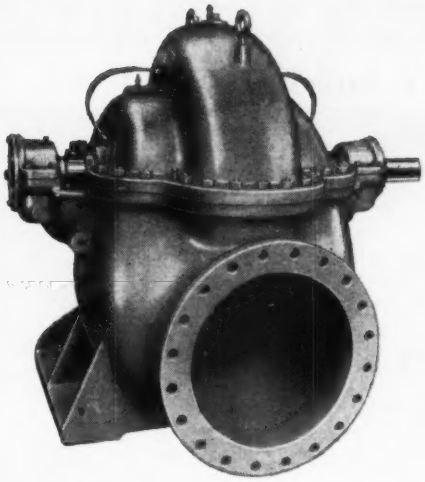
your master key to cost savings in power equipment

Carpenter

Stainless Tubing & Pipe

For more facts circle 343 on Reader Service card, p 101





Which pumping system is for you?

Phil Olmstead,
Chief Engineer, Goulds Pumps, Inc.
tells you how to find out

The mammoth pump you see here—Goulds Fig. 3420—can handle up to *40,000 gallons per minute!* Think of it—enough to fill an average-size swimming pool in less than a minute!

Yet with two or more smaller pumps in parallel—such as the Goulds Fig. 3405 centrifugals, also shown here—you could fill that swimming pool just as fast, though your strength would be divided.

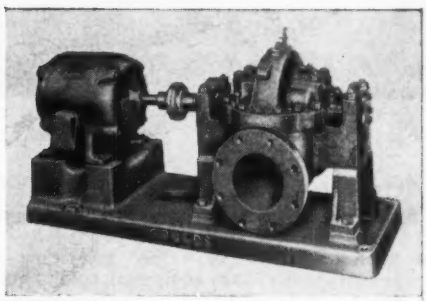
Which is the most effective way to do it?

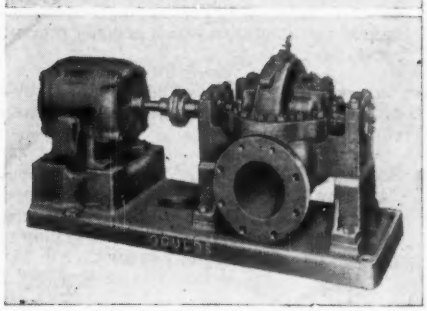
ONE PUMP?

1. With the Fig. 3420, you make just one installation, thereby save installation time.
2. Your installation takes up less space.
3. Your piping is simpler and less expensive.
4. You pay a lower initial cost: one pump, one driver, one coupling.
5. Your operating costs are lower. Big pumps have inherently higher operating efficiencies; you save on power.
6. You service just one pump; maintenance costs are lower.

TWO PUMPS?

1. During critical periods, having a *battery* of Goulds Fig. 3405 centrifugals can save the day: all "eggs" are *not* in one "basket."
2. The flexibility of two pumps lets you accommodate varying needs more efficiently.
3. Smaller pumps are easier to handle, therefore easier to install and maintain.

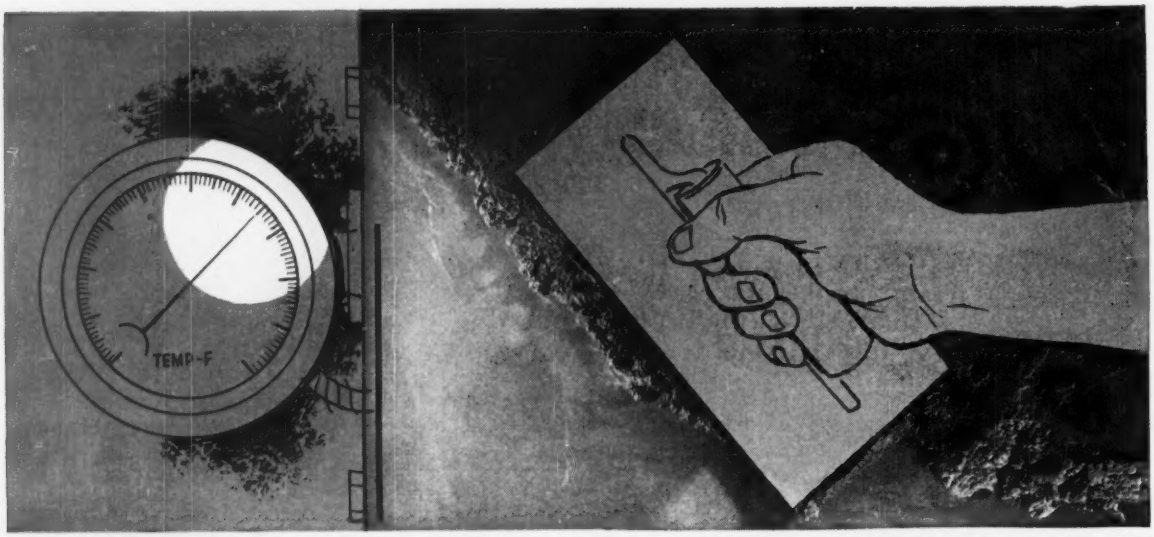




These points might make you wonder which system *is* right for your needs specifically. To be sure *all* important considerations are covered before you make your final decision, call in a pump specialist. Goulds application engineers help pump users make decisions like this all the time, will be glad to help you determine which system most accurately, economically and efficiently meets your needs.

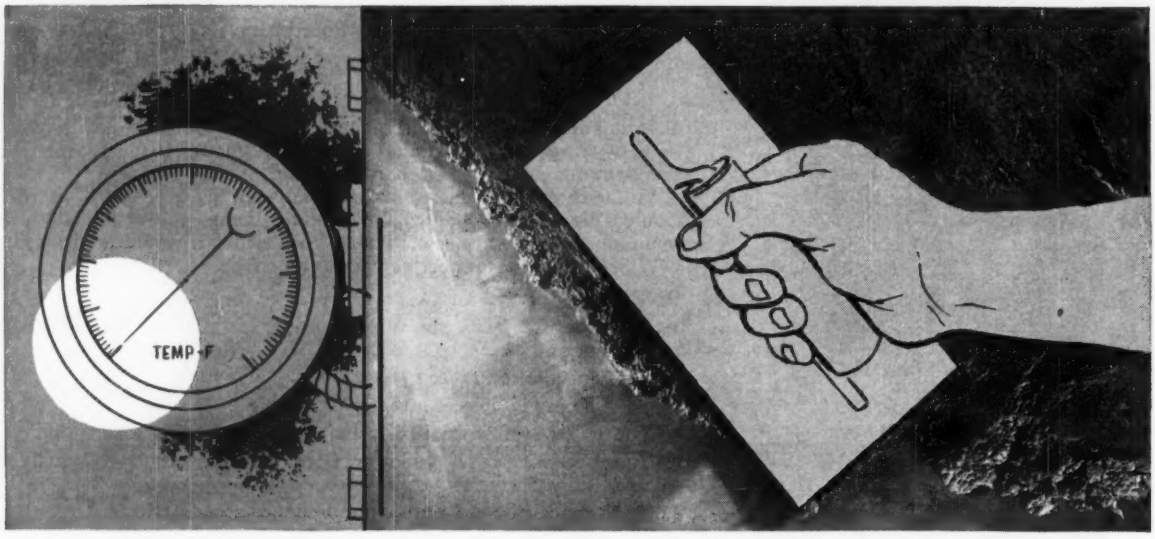
I can help you get in touch with a Goulds application engineer if you write to me, Phil Olmstead, Goulds Pumps, Inc., c/o Dept. PO-119, Seneca Falls, N. Y. I'll also forward any information you might want on the pumps I've mentioned.

GOULDS GP PUMPS



IT STICKS TO HOT OR COLD SURFACES!

. . . and it's rust inhibitive!



EAGLE-PICHER

SUPER "66"

INSULATING CEMENT

Eagle-Picher produces a complete line of industrial insulations for all temperatures from below Zero to over 2000 F.

EAGLE EP PICHER

Since 1843

The Eagle-Picher Company
Dept. P-11
General Offices: Cincinnati 1, Ohio

Here's why you save money when you use Eagle-Picher Super "66" Insulating Cement

- Because it sticks, Super "66" saves time — applies quickly to any equipment, cold or hot. Effective up to 1800°F. . . . and it contains a special rust inhibitive which actually prevents corrosion !
- Because it sticks, Super "66" saves money— provides far greater coverage and more efficient insulation.
- Because it sticks, Super "66" makes difficult jobs easy—can be used on irregular shapes where application of other insulations is often impossible. Usually requires no reinforcing on applications up to 1½ inches thick.

For more facts circle 345 on Reader Service card, p 101

STEVE ELONKA
Associate Editor in Charge

a Today's Development report

In this astronautical age, you must . . .

Update your *PM** thinking to stay in orbit

"Diagnostic", "total destruction", "spot checking" mean increased production in the space-age maintenance man's dictionary. Let's see how these techniques can fit your needs

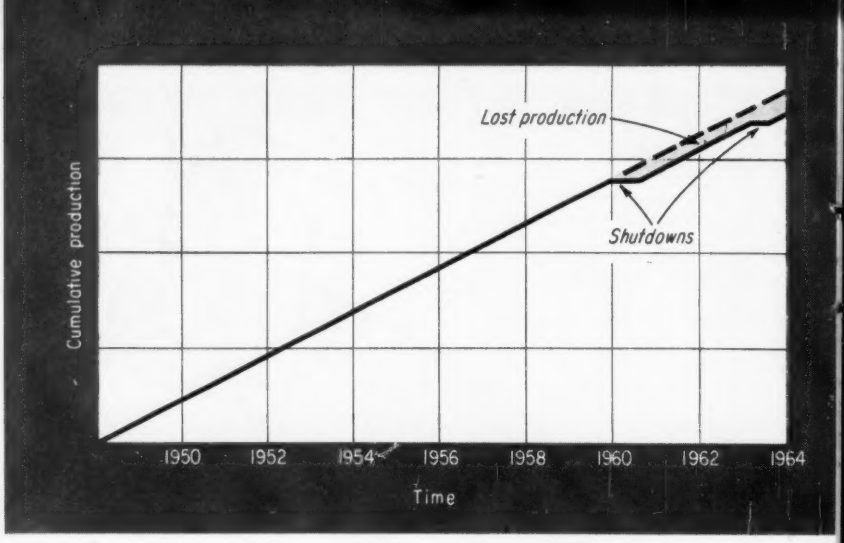
By STEVE ELONKA, Associate Editor

Do you know that two-thirds of the net profit in most industries is soaked up by maintenance and repair costs? So to get the latest thinking on *PM*, I made a 10,000-mile flying trip to our largest aircraft and missile firms. Their up-to-date thinking might help slash your high costs.

Rather than going into specific plans, ideas here have to do with the philosophy of *PM*. Use them as a starting point. But whatever you do, you must be hard-boiled about your machines. Either they increase productivity or they don't. Either they are worth nursing along, worth planning for, or they should get the ax. Let's run some of the latest *PM* ideas up the flagpole and see which ones are worth saluting.

continued

*Preventive maintenance



DIAGNOSTIC *PM*

Here outages are at a minimum because you keep accurate performance records and shut down only when readings indicate it would be dangerous to run longer

First step: buy the toughest and most modern

An ideal machine would produce at top design capacity forever, with absolutely no shutdown. While such a machine is undoubtedly a pipe dream, one large utility firm has a steam turbine that's been on the line for over seven years without being opened for repairs. And they're pushing for a 10-year endurance mark.

Another utility opens its boilers only once every three years. Their insurance firm approves. I know of several barrel type feed pumps that haven't been opened in 15 years—120,000 hours.

A few years ago this procedure, like the 4-minute mile, would have seemed impossible. In either case our own mental outlook may be the deciding factor. So let's see what methods are being used to stretch productive time by reducing outages.

Diagnostic method. Basically we follow our doctor's routine with this system. He'll only cut us open if his diagnosis indicates that there's something radically wrong inside—and we do the same with machinery. With equipment built, installed and protected properly, smart operators use this method to stretch periods between shutdowns, above.

Here, proper operation is most important. Keeping log sheets hourly is a must. And knowing how to interpret the readings can spell success or failure for your plan. Of course some insurance firms still require you to open pressure vessels yearly for inspection, and other equipment may come under this yearly inspection rule—here your diagnostic method is good between annual shutdowns.

Let's take a large steam turbine. By "smart operation" we mean logging the temperatures, pressures and vibration readings hourly and calculating the water rate daily. Centrifuging lube oil continuously and keeping it at the right temperature and pressure should prevent bearing trouble.

An increase in water rate indicates more steam consumed by the machine for a given load. That may be caused by erosion of blading or leakage of steam past diaphragms, or it can even mean missing blades. Double-check your diagnosis against hourly vibration readings. After running the machine continuously, until the diagnosis indicates that the danger point is near, you'll have a performance curve like the one shown in the chart, above.

Regardless of machine type, start with best possible equipment and installation, then do a top operating and diagnosing job.

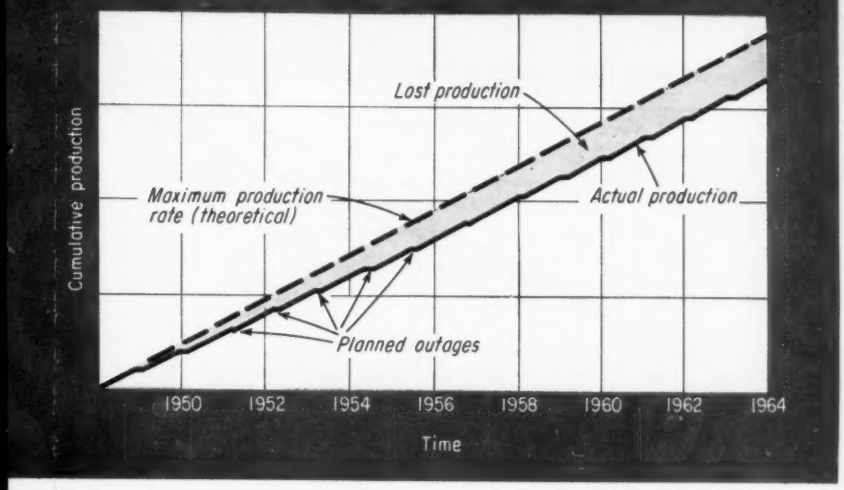
Scheduled *PM* plan, next page, isn't new. It's known by many names. Basic plan calls for shutdowns at regular periods. The Navy, as well as many industrial plants, follows this method. Where a plant or ship shuts down for several weeks annually it may pay to open critical equipment, check thoroughly and make repairs.

Here your outages are planned for a given date. If you operate smartly, taking all precautions against unexpected breakdowns, this plan is reliable though costlier than diagnostic method.

Spot inspection method is practical where you have many units of same make and design, or where the service is similar, as with hundreds of motors or pumps. Instead of checking all similar motors at a given time, open only one, assume that others are in the same condition. In plants where accurate operating records are kept, this method is saving a lot of money.

Unplanned maintenance, p 194, above, is costliest of all. You just don't know when to expect a breakdown if you take no precautions against one. Lost production area on curve can be so large at a critical time that it bankrupts your firm.

Total destruction plan, p 194, below, may be a constructive way to lower maintenance costs of some equipment. Idea is to operate with no maintenance whatever until equipment fails completely, then replace with new machinery. Today



SCHEDULED PM

Using this system you set time most convenient to your production schedules for maintenance shutdowns. System is dependable but it can be very costly

machine that can be designed

many smaller mechanical and electrical units are made as throw-aways. Spares are handy at point of use so changeover is simple and quick.

In one plant I saw two pumps hooked up to the same system. As soon as one failed, the other would take over and worn pump was scrapped.

The plant engineer said they had opened those pumps at scheduled periods for years. Then he found that with increased labor and parts costs, repairs cost more money than a new pump. It's actually cheaper to run the machine to destruction.

Electric motors up to one horsepower aren't repaired by many large firms today, but thrown away, replaced with new. Such motors are standard models carried in stock. Small molded-case circuit breakers come with plug-in features. If one fails, just plug in a new one, throw away the old.

Any successful maintenance plan requires you to set up equipment records, checklists for machine inspection, report forms to department heads, cost records, schedules, etc. Regardless of plan you adopt, these forms must be tailor-made to suit your plant. I've yet to see paper work exactly alike for any two plans.

Analyze your schedule periodically. Then you may want to revise frequency of inspection, redesign the weak parts, substitute better materials, change method of operation, replace obsolescence.

Regardless of the *PM* plan you adopt, first step is to start while the machine is in the design stage. This is especially true where a shutdown can cost thousands of dollars per minute, hour, or day. Nothing should be spared to get as near perfection as possible. Airplane builders are leading the way here, for failure often means total loss of equipment—and loss of life.

Tough machine. You can do many things to get the toughest machine possible. Balance original cost of the needed improvements against the downtime costs to know how far you can go. Today, many newer materials are on the market to stretch machine life.

High-silicon irons, cast high alloys (iron-chromium and iron-chromium-nickel), copper bearing steels, nickel and its alloys, titanium are just a few metals that help lick corrosion, erosion and wear. (See POWER's 32-page reprint, *Corrosion*, Dec 1956.) Chrome-coating compressor piston rods and diesel cylinder liners increases resistance against abrasive-laden gases.

Coating with plastics and ceramics protects against acids, heat and wear. Neoprene coating inside machinery housings resists acid fumes.

Wearing parts can be hard-surfaced in various ways. You can braze tungsten-carbide plates on coal crushers, or hard-surface valve faces, camshaft lobes, gear teeth. Other surface-protection ideas are electroplating and hot-dip coating, carburizing, casehardening. (See POWER's 16-page reprint, *Hard Surfacing*, March 1953.) Remember that the difference between a new piece of equipment and one ready for the scrap heap is often no more than a few pounds of metal worn from critical parts.

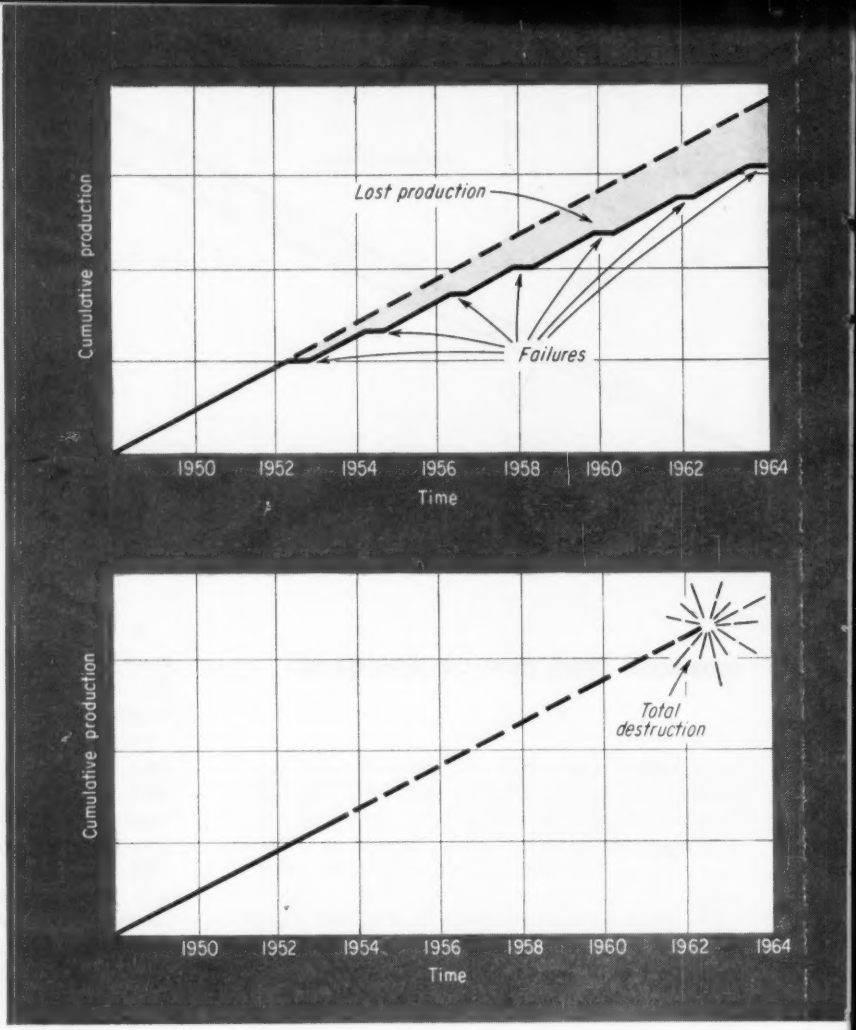
On the electrical end, silicones, epoxy resins and encapsulated-insulation methods do a tremendous job in preventing current leakage and moisture damage. (More on silicones on p 66, this issue.)

But not even using the best materials will insure you against a sudden breakdown when you start up new equipment. All materials contain flaws. Only way you can be sure these flaws are not in critical areas is to have machinery nondestructively tested. Today's NDT methods include X-ray; isotope radiography; fluoroscopy; ultrasonic, eddy-current, magnetic-particle and fluorescent-liquid testing; many others. (See POWER's 24-page reprint, *Nondestructive Testing*, March 1958.)

Fabricator can also make a complete test of the unit before shipping. For example, most manufacturers performance-test pumps at a slight extra cost. That tells you if machine will work to capacity, with no short-circuiting stages, etc. **continued**

UNPLANNED MAINTENANCE

Because you have no plan, breakdowns may come at most embarrassing times. This is extravagant way to run a plant, has suddenly bankrupted many firms



TOTAL DESTRUCTION

For smaller equipment and even auxiliaries, it may be profitable to operate with no maintenance until machine fails completely, then replace it with new unit

Second step: adopt a *PM* program, then tailor the scheduling, records and accounting to suit your plant's requirements

Vibration. A must today is to dynamically balance rotors of rotating equipment at the factory. (See POWER's 24-page reprint, *Balancing*, June 1959.) When installing, be sure to isolate your machine from vibration and noise. Bearings of idle machines have been knocked out by vibration carryover from running equipment. A common problem is delicate laboratory equipment and instruments damaged by vibration from other sections of the building.

There are floating foundations, isolation pads, flexible piping, electric cables and pipe hangers to consider when installing equipment. These extend the life of a well-balanced machine, confine vibration and reduce noise. Look for a special report on *Vibration Isolation* in an upcoming issue.

After your equipment is installed and coupled to other machines, make a complete vibration check, compare against tolerance readings furnished by the manufacturer. A machine balanced on assembly floor often vibrates when mounted on its permanent foundation. If connections such as piping, conduits and shaft couplings are rigid, vibration may be excessive, especially after lines and machines attain their normal running heat. Then expansion often puts severe strain on equipment, resulting in metal fatigue and ultimate failure.

Safeguards. Today there are many ways to detect and prevent damage. Supervisory instrumentation gives you information on temperatures, pressures, vibration levels at the flick of a selector switch. Relief valves bleed off excess pressure,

Accounting machines automate maintenance control

More and more paper work is being reduced with accounting machines. Which ones you use depends on your individual program. But some of these machines should complete your *PM* picture and put your plant in a better profit position

Key punch. Records information by punching holes in cards

Verifier. Checks key-punched holes for accuracy. Stops on any error, flashes a red light

Interpreter. Translates punched data into printed data at top of card

Reproducer. Takes info from an original key-punch card, duplicates it on a flock of cards. Moves data around on cards, omitting or adding some. Reads mark-sensed cards, translates info into punched holes

Collator. Selects cards that hold same info, merges two sequences into one

Sorter. Groups cards according to data punched in them. For larger groups (wider range of data) you run cards through again and again

Calculator. Adds, subtracts, multiplies, divides; punches answer

Tabulator. Computes totals by adding or subtracting; prints reports

Automatic transfer poster. Transfers printed information from tabulated sheets to large ledger cards

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flame-safety devices and low-water cutoffs prevent boiler failure. Vibration detectors stop your equipment before vibration reaches dangerous levels, and even automatically start standby equipment.

Centralized lubrication systems assure automatic lube at each bearing. Fire-resistant lubes prevent destruction from heated lines or flames. Rupture disks, explosion doors, cathodes, fuses, circuit breakers prevent everything from crankcase and furnace explosion to corrosion, electrical failures.

Obsolescence is another area getting a searching look. You've got to be cold-blooded and throw out inefficient equipment. General Electric Company points out that in 1927 it took 75,000 people to turn out 90,000 light bulbs per hour. In 1934 only 4000 employees were needed. In 1954, 230 employees produced the same 90,000 bulbs per hour. Revamped machinery, techniques led the way to this manhour reduction.

Smart planning calls for a hard look at insurance costs and fire prevention. These are a big part of the *PM* picture. You cut not only maintenance costs but also insurance costs through a good *PM* program. Insurance rates are based on industry loss and experience. So if over a long term you reduce accidents and breakdown, improvement will be reflected eventually in lower premium rates.

You may cut your own costs by one or a combination of all these ideas. Remember, preventive maintenance must go beyond any negative concept. Consider *PM* as important as production itself.

Reprints available

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OPERATORS' NOTEBOOK 133

Fire protection for

Here's how the world's tallest building is protected with pumps, tanks and valves

Skyscrapers are being erected in increasing numbers because land is at a premium in crowded cities. But a number of problems peculiar to tall buildings are created—fire protection is one. Municipal fire department must be assisted by an in-building fire-protection system to assure an unfailing water supply.

Topnotch skyscraper fire-protection system safeguards the Empire State Building in New York City. The 103-story Empire State Building soars 1472 ft into space. It's used daily by 51,000 people—16,000 tenants and some 35,000 visitors.

Fire protection here starts in the sub-basement. Two 750-gpm house pumps in the sub-basement feed the 15,000-gal siamese reserve tanks on 21st floor. These include one 10,000-gal tank for house use and a 5000-gal tank for fire reserve. A third 750-gpm house pump in the sub-basement feeds the 5000-gal house tank on the 46th floor. This, in turn, down-fills the 5000-gal fire-reserve tank on 42nd floor and 5000-gal house tank on 31st floor.

A fourth 750-gpm fire pump in the sub-basement is a spare, ready to take over requirements of 46th-, 42nd- and 31st-floor tanks.

The 750-gpm fire pump in the sub-basement feeds the 15,500-gal tank on the 85th floor, of which 12,000 gal are for domestic use and 3500 gal for fire reserve. This pump also down-fills the 17,000-gal tank on the 63rd floor, of which 12,000 gal are for house use and 5000 gal are reserved for use in case of fire.

Highest tower tank on 102nd floor is fed by a 250-gpm pump located on the 84th floor. This tower tank provides 5000 gal for house use and a 3500-gal fire-reserve cushion.

No tanks are ever below the fire-reserve level. A series of high- and low-level floats automatically assures proper water level in the tanks. These levels are preset by the chief engineer to meet building needs. If a tank falls below the designated level, an alarm bell rings on the sub-basement control board. Then the alarm must be turned off manually, trouble located, pumps put back in normal operation and the tank refilled.

Since the 4-in. city main cannot supply enough pressure, a 10,000-gal siamese tank in the sub-basement supplies pressure for the house pumps. Another 10,000-gal fire tank in the sub-basement provides pressure needed for the fire pump.

Standpipe risers are fed from sub-basement up. Sub-basement 750-gpm fire pump feeds the standpipe system up to 20th floor. Other pumps are on 41st, 62nd and 84th floors. Each pump can, in emergencies, bypass the pump above it. For example, if pump on 20th floor is out of service, the unit in sub-basement can feed the standpipe system up to the 41st-floor fire pump.

The 100th, 101st and 102nd floors present a special fire-protection problem. The 103rd floor is 1300 ft above the sidewalk, far above the point reached with conventional fire-fighting equipment. Water supply for these three upper-floor outlets is connected directly with the standpipe system in the building.

Since top floors in world's tallest building are the most difficult to reach with conventional equipment, let's look at the special equipment used to insure adequate water supply. Reliability is the chief requirement —equipment must go into instant action without fail any time it's needed.

tall buildings demands top gear

By STEVE ELONKA, Associate Editor

Top floors are valved like this for instant action

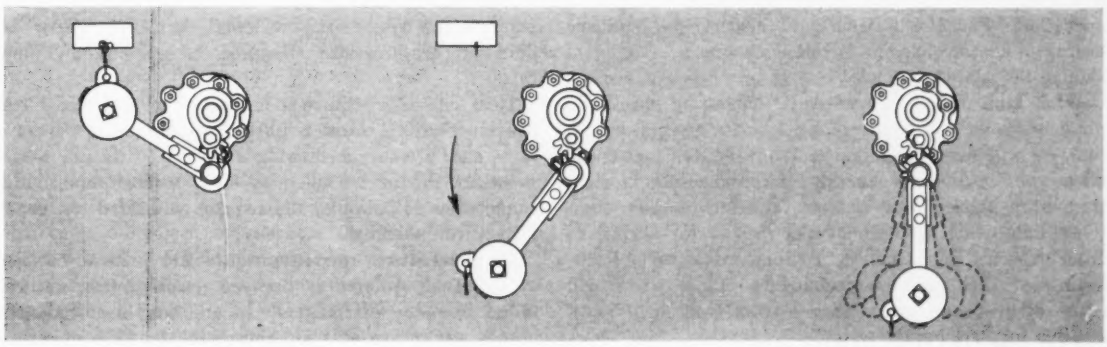
When a fire-alarm box on the 100th, 101st, 102nd or 103rd floor is broken, an electric trip causes the actuating weight of the pendulum stop valve, right, to drop instantly. That diverts water under pressure to the fire-control system. At the same time a centrifugal, motor-driven 250-gpm fire pump on the 84th floor begins to deliver water into upper-level standpipe.

Valve used was designed by Everlasting Valve Co for positive action and unfailing response. Unique feature of this unit is that it needs no arrester. At bottom of swing the weighted pendulum disengages from valve mechanism. That prevents the valve's working parts from contacting the edge of valve body, so impact won't fracture the component. Soon as valve comes to desired position, weight and lever swing free in pendulum fashion until weight comes to rest. When weight is raised to reset the valve, gears automatically remesh correctly.

These valves don't stick because they are made of materials that resist corrosion under working conditions. They don't wedge because the disk travels in a line parallel with both the interior of the upper bonnet and the seat. Straight-through design permits unimpeded flow.

CHIEF ENGINEER Tom Deacon examines the quick-acting weight-operated pendulum stop valve. It diverts water to top floors

Reliable pendulum stop valves are heart of system

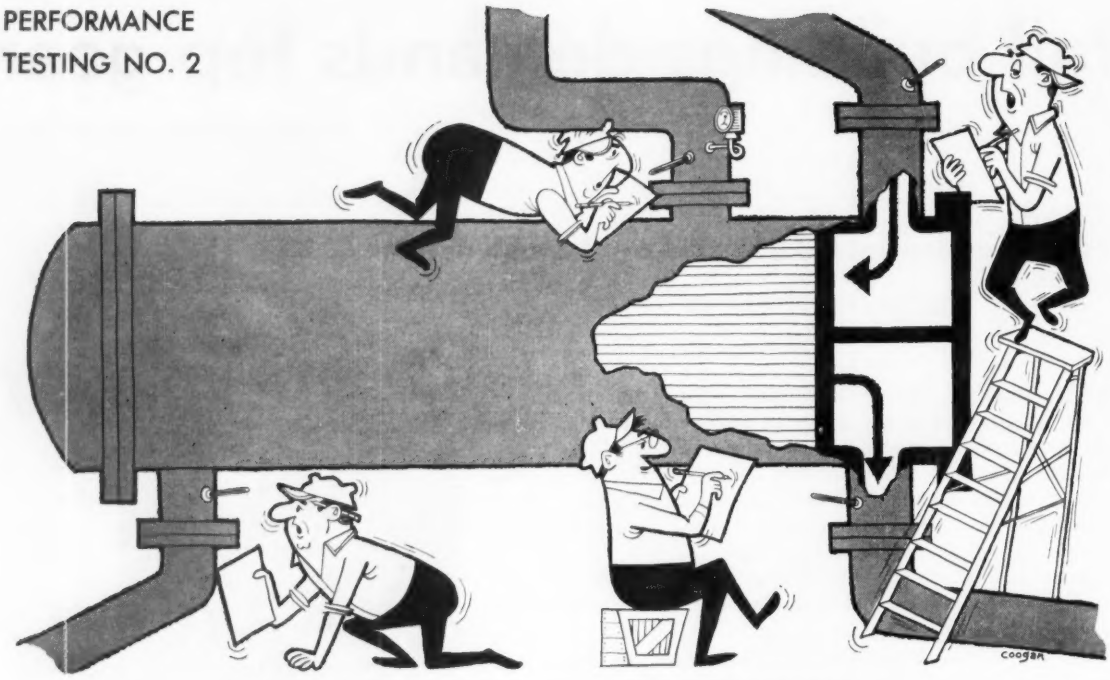


READY FOR INSTANT ACTION, this valve is held in open position shown by means of a link attached to the releasing device. Once it's released, gravity does the rest

WHEN RELEASED, the weight swings in an arc. Motion is transferred to the valve disk through gears. In the position shown, valve is fully closed and gear is locked

WEIGHT continues to swing in the pendulum movement shown until it comes to rest. Because the disk travels in line parallel with the seat there is no wedging

PERFORMANCE
TESTING NO. 2



TEST RESULTS are only as good as instruments, special techniques and men permit

How to test your heat exchangers

Part 2 of a series on performance checks of power services can help you set up practical tests to spot operation deviations, maintain peak performance of heat exchangers

By L E STEWART, Assistant Editor

Periodic tests of heat-exchange equipment can spot some potentially costly troubles before they appreciably affect operation. For this reason, and because performance testing of heat exchangers is relatively simple, your plant should be geared for adequate tests whenever needed.

What kind of tests are needed? Operating checks do not require the rigid test conditions of a guarantee run, but you will need to account for any factors that could affect your results. In general, performance checks must start from a basic heat balance, and include any additional data which would help spot reasons for deviations from expected performance. In this article we describe testing of shell-and-tube exchangers. Later parts will cover other basic types. (See POWER, March 1959, p 204-205 for Part I of the series.)

Exploratory tests are basic to any operation. These include accurate heat balances and possibly measured pressure differentials. Where contamination of fluids is a problem, stream analysis may be a basic test measurement. Results of exploratory checks define your needs for further precision tests. Within the limits of basic exploratory tests, measurements normally consist of fluid temperatures and pressures, in and out, and flow rates.

Heat balances require a minimum of specialized test instrumentation. Most important of these are temperature- and pressure-measuring elements. Pressure measurements should be taken as close to inlet and outlet connections as possible, and require calibrated test gages for accurate readings.

Temperature measurements are critical because of the small differences between terminal temperatures found in many exchangers. In addition, heat balances usually use measured temperatures in the form of differentials. Under these circumstances random errors owing to use of several separate elements can sharply reduce accuracy of test results. One solution uses calibrated thermocouples with one potentiometer. Error from in-

strument calibration acts equally on each reading, affecting absolute accuracy. When using temperatures as differentials this instrument error cancels out.

Thermocouple bucking adds a further refinement to the differential reading system. In this case two thermocouples are connected so generated voltages oppose. Potentiometer measures the voltage difference, which is proportional to the actual temperature difference. If stray electrical currents appear to be upsetting readings, an electrical chopper circuit will allow isolation of the two elements. Commercial chopper units are available, or the switch can be the subject of a do-it-yourself project. For additional information on this operation contact experts in this field—manufacturers of thermocouples and measuring instruments.

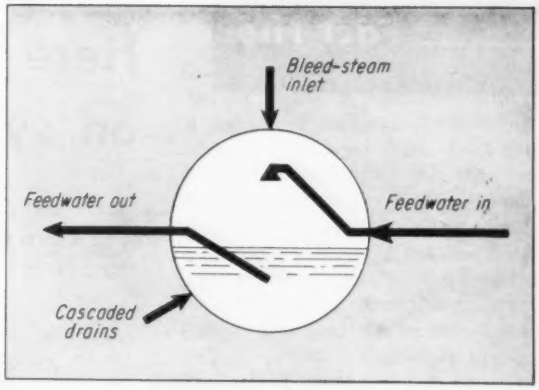
Flow measurements usually represent a trouble spot with respect to data accuracy. Commercial tolerances for flowmeters and primary elements reduce certainty of high absolute accuracy. Fortunately, heat balances do not require measuring all input and output quantities. A simple closed feedwater heater has six operating variables. Data-wise this heater represents four enthalpy values and two fluid flows. Data on any five of the six items allows a solution to heat-balance calculations. Since temperatures and pressures are usually easy to measure, the unknown quantity is often a flow.

Feedwater-heater tests are a prime example of heat balances using one flow. In just about any performance test of a power-plant cycle, feedwater flow is a key quantity. It's also one of the easiest flows to measure accurately. As a result, most heat balances for feedwater heaters are calculated from feedwater flow plus the four enthalpies. Results are thermal load in Btu per hr and heater bleed-steam flow. For plant cycles which include cascading of each h-p heater drain to the lower-temperature heaters, heat balances usually start with highest-temperature unit and work back through the cycle. Flow diagrams and calculations, right, show this general case for open and closed heat exchangers.

Spotting trouble from test results calls for knowledge of type of tests to run for greatest sensitivity to operating changes. For example, heater fouling will eventually show up in pressure drop readings, but long before that stage is reached, overall heat-transfer coefficient (U) signals trouble. Apparent coefficient variation can mean internal leakage or bypassing within heater shell. Although all these operating problems can be diagnosed from performance-test results, early symptoms are reflected as slight changes in performance. This governs test precision requirements, limits your ability to spot troubles early in their development.

Test accuracy should be firmly established before you get too deeply involved in analyzing results. There are some statistical approaches available, but for the normal plant a good first estimate can be made based on the repeatability of instrument readings and instrument calibrations. Using the plus or minus error for pressure, temperature and flow measurements, assume errors for each reading in direction resulting in greatest cumulative effect on final answers. Apply these errors to design values and note total error. Performance deviations within this error range should be discounted.

Open heaters: multi-inputs = one output



Heat balances for open heaters are simplest operation. Calculations merely require summation of heat inputs, which must equal single heat output. If you work in terms of Btu-per-hr units for each input complicated formulas are unnecessary. Basic formula is:

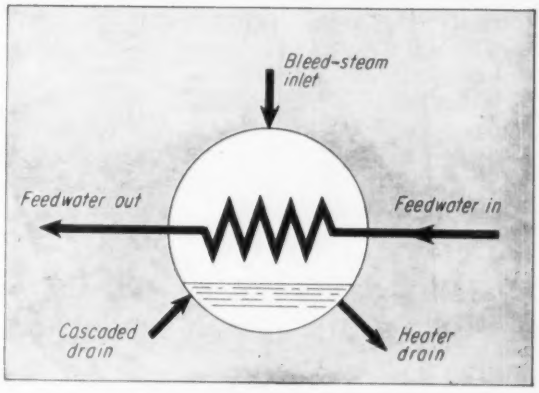
Heat load, $q = W\Delta H$ or $W\ C\ (T_1 - T_2)$

Where W = flow in lb per hr of fluid, H = enthalpy
C = fluid specific heat, T_1 = inlet temperature,
T_2 = outlet temperature

For change of state, ΔH form of equation is used.

In balancing heater above: $q_1 + q_2 + q_3 = q$ out

Closed heater involves conductivity test



Basic heat balance for closed heater may be calculated by summing heat quantities, q, as above, but colder fluid-flow quantity remains equal for input and output.

Because heat transfer occurs through metal tube, a measure of heat-transfer efficiency is needed. This is in the form of overall heat-transfer coefficient. General formula for coefficient, U, is:

$$U = \frac{q}{A \times LMTD} \text{ Btu/ hr/ sq ft/F}$$

Where: A = effective outside area of tubes, sq ft
$LMTD$ = log mean temperature difference, F

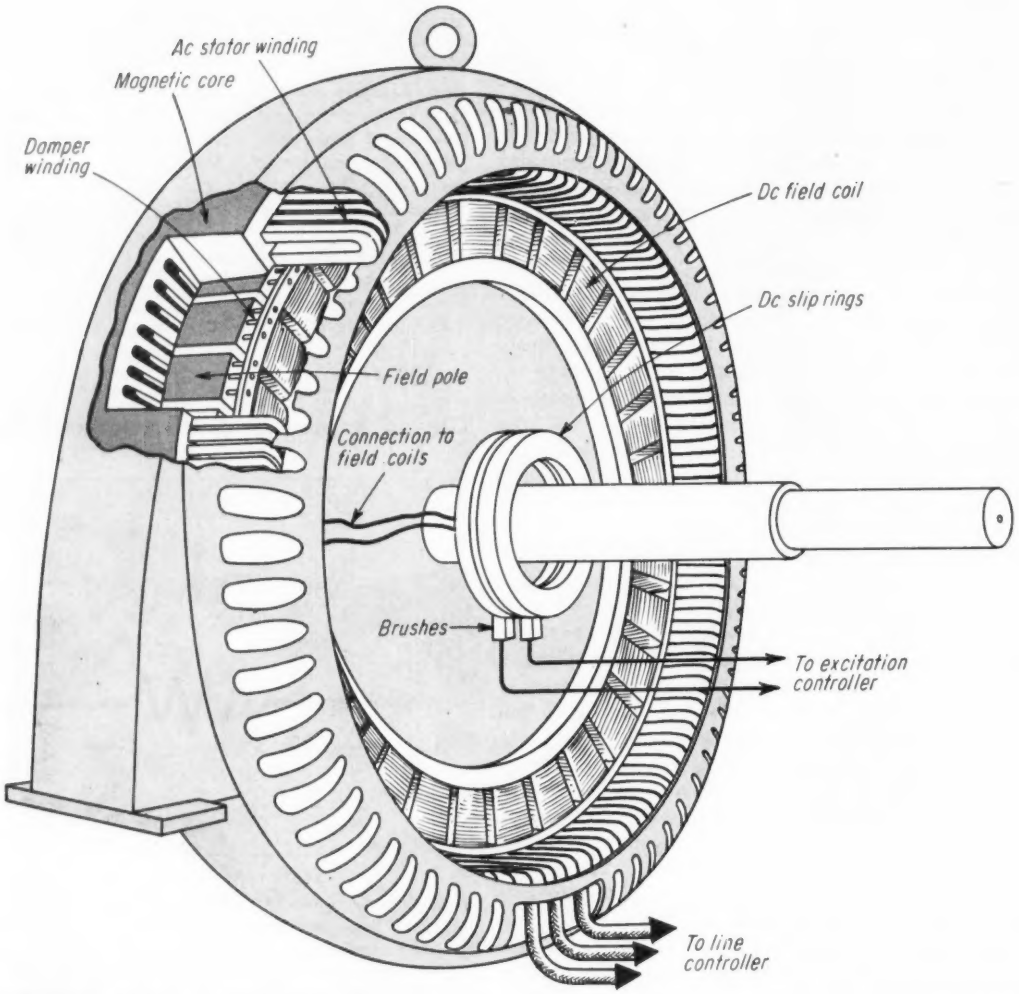
Log mean temperature difference calculations vary with flow paths, design of heater. For more about calculations, refer to POWER's report, *Heat Exchangers*, June, 1954.

Plant Electrical Fact File

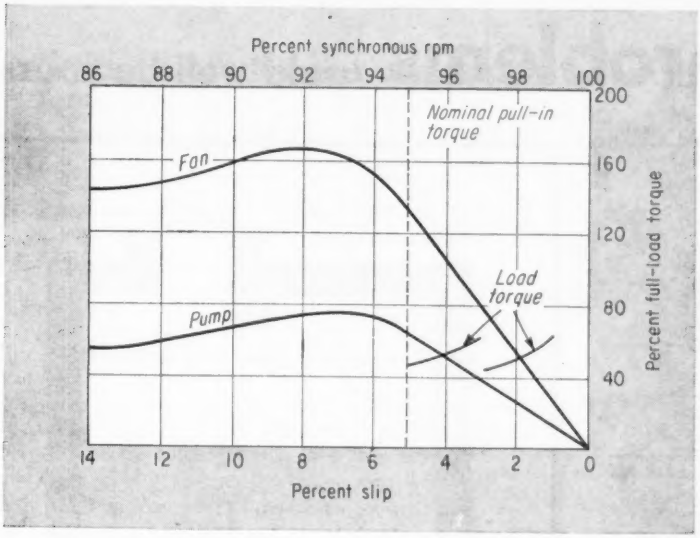
NO. 41: SYNCHRONOUS MOTORS

Here are some pointers on synchronous motors

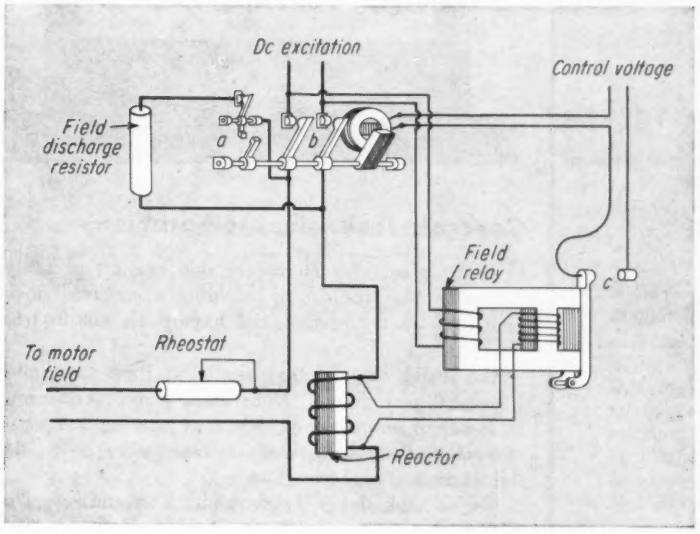
By NORMAN PEACH, Associate Editor



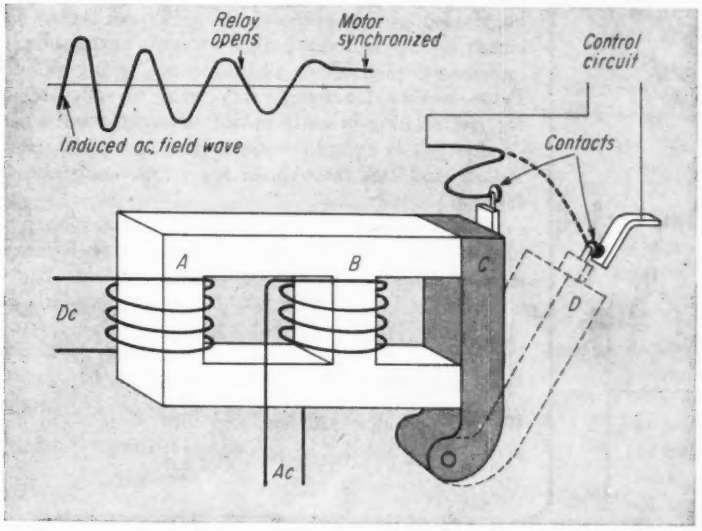
ROTATION of synchronous motor depends on interaction of ac-stator and dc-rotor magnetic fields. Rotor has field coils fed through slip rings. A squirrel cage is embedded in field-pole tips to provide a damper or *amortisseur* winding which starts the synchronous motor as an induction motor. (Same winding also serves to damp rotor oscillations.) A coil-wound damper winding, as in slip-ring motors, is sometimes used to get extra-high starting torque. Dc field isn't excited when starting, but is energized as rotor comes near to synchronous speed. Stator power can be applied by any of the starting methods described in *Fact File* No. 6, Sept 1956. Synchronous motors can improve distribution-system power factor (*Fact File* No. 20, Dec 1957) by overexciting the rotor field.



SIX TORQUES must be considered when you apply synchronous motors. Torque curves of the motor must suit load requirements as shown. *Starting torque* is breakaway torque at instant of starting. *Accelerating torque* is developed from stand-still to pull-in speed. *Pull-up torque* is minimum torque developed between stand-still and pull-in. *Pull-in torque* is developed during transition from slip speed to synchronous speed. *Synchronous torque* is steady-state torque developed during operation. *Pull-out torque* is defined as steady-state torque developed for one minute before the rotor pulls out of synchronism because of overload

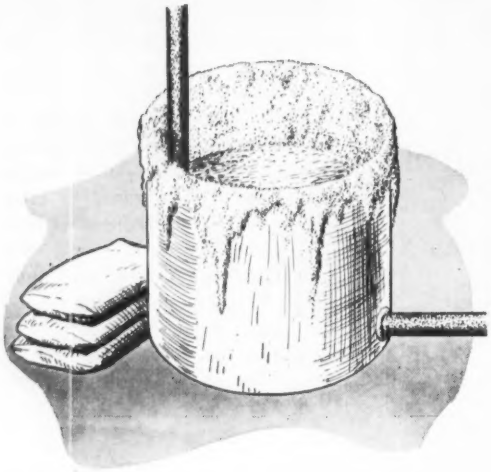


FIELD-CONTROL circuit for typical synchronous motor automatically applies excitation at pull-in speed, which is slightly below synchronous speed. Field winding is shorted with discharge resistor in series during acceleration and contributes to starting torque. Field relay energizes contactor which opens shorting contacts, applies dc to field. Field current is adjusted by rheostat (manual or automatic). When excitation is shut off, field-discharge resistor is reinserted and absorbs discharge energy preventing buildup of high voltages as the field magnetism decays



ENERGIZING of field at pull-in speed is usually accomplished by a *field-frequency relay*. At stand-still the frequency of ac induced in the short-circuited field is same as stator's. As rotor speeds up, the frequency decreases. Ac of field frequency is applied to coil *B*. Dc coil *A* bucks out negative half-cycles. While frequency is high, positive pulses are close enough together to hold relay armature *C* closed. When frequency becomes low enough, armature drops out to *D*, closing the contacts. This scheme applies excitation at most favorable moment, when the rotor poles and the poles of the stator are approaching direct opposition

These **plant problems** could well be yours...



The problem

How can we increase the life of our salt storage tank?

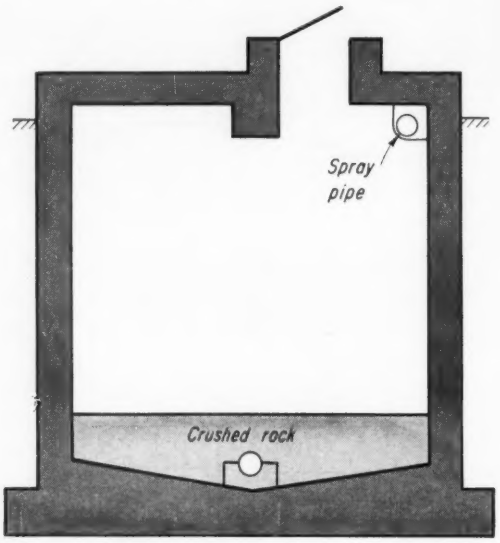
Water treatment at our plant is handled by a pair of pressure filters followed by sodium-zeolite softeners. The equipment works well but the salt-storage tank gives us no end of trouble.

No matter what we do it always seems to look sloppy. Salt accumulates at the upper edges. Outer surface of the tank corrodes as this salt accumulation actually creeps over the top edge. Lower portion of the tank is also rusting away. Brine solution occasionally overflows and salt crystallizes on the bottom tank supports.

The tank is used until it practically falls apart, then we replace it. But I'm sure there is a better way to handle this problem. We'd like some ideas from readers with similar experiences.—*BCR*

Want some help on plant problems? Send us any of your design and operating headaches. We'll put *Power* readers to work on them

The solutions



Concrete tank solves salt problems

If *BCR's* plant uses an appreciable amount of salt, he can solve his problem by building a concrete storage tank sunk in the ground and buying his salt in truck-load lots.

The sketch shows a tank similar to three installations I have helped design. Dimensions were recommended by local salt companies as right for emptying dump truck without touching salt. Walls of tanks were 10-in., floor slab 12-in. and roof 6-in. thick.

Size of tank should be determined by amount of salt *BCR* wishes to keep on hand. Assuming one truck-load as amount that he wishes to order at a time, tank should be sized to hold minimum of 1½ truck-loads. This means ½ load in reserve when ordering next load.

Brine pump should be all bronze, and piping all brass. Pump is used for transferring brine to softeners and for recirculating brine to obtain saturated solution.

After salt is dumped, tank is filled with water. Brine is then circulated through the spray pipe until saturated solution is obtained.

If *BCR* confers with his local salt company, they can give him valuable information on designing a tank to meet requirements of his particular plant.

H A Livingston, *Los Angeles, Calif.*

Add inhibiter for corrosion control

We had a similar problem, and conveniently and inexpensively corrected it by adding approximately one lb of

LAWSON STEWART, Assistant Editor

sodium hexametaphosphate to each 100 lb of sodium-chloride rock salt whenever we prepared a new batch of brine solution. Corrosion and salt crustation ceased.

W A HOESE, *Clifton, N. J.*

Wax coating stops hygroscopic action

Having been in charge of a municipal water plant which used a lot of salt, I've run into problems like *BCR's.*

Salt entered the top of mixing tanks where water was added to develop a saturated solution. Our troubles began because of the marked hygroscopic action of the heavy solution. Salt incrustations crept up the tank interiors above the liquid line, over the edge, and down the exterior. Good housekeeping demanded removal of this stuff and only constant scraping and brushing kept the place presentable.

Stealing a page out of the early electrician's book we scrubbed down the offending edges, coated them once again with hot bitumastic material and finally covered this with a generous layer of warm paraffin. The hygroscopic action stopped and there were no further signs of corrosion. Bitumastic material does not make the most beautiful surface, but is sturdy and easier to maintain where banging salt bags might chip painted edges

E E CROSS, *Oak Ridge, Tenn.*

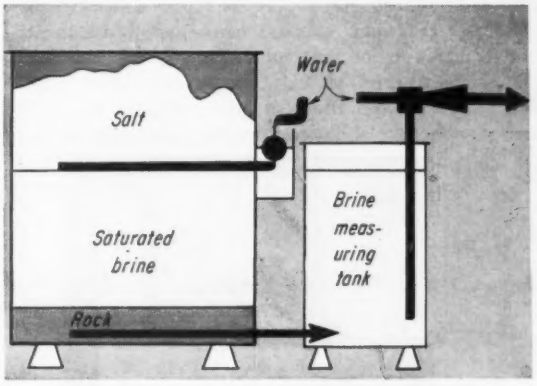
Redesigned tank cuts salt corrosion

BCR's problem is often encountered in new and old plants. A short time after we started our plant we had trouble with salt-storage and brine tanks. Salt crystals crept up and over sides of tank even when brine level was 12 in. below the top. We also had trouble cleaning out sediment and gravel from brine-tank bottom.

We started rebuilding as soon as we had time, scheduling our work to keep the brine tank in operation with only short periods out of service. We built a concrete base 2-in. high. This prevented water from collecting in the immediate area. Next to the brine tank we installed a floor drain. A frame of angle iron supported the tank. With tank in operation we welded on a clean-out frame with bolt-on door and gasket slightly larger than a square-point shovel. After draining tank we cut out the hole and ground it smooth. Then we cleaned inside of tank down to bare metal and applied rustproof bitumastic paint.

After paint dried, we heated the tank from outside with a torch and applied a coating of paraffin on the inside to approximately two in. below normal brine line by rubbing it against the warm metal. Salt will not creep over a paraffin-coated surface, so our troubles were over.

E L KIRCHMEIER, *Albuquerque, N. M.*



Salt cap prevents evaporation

Following suggestions may help *BCR* extend life of his storage tank and also facilitate brine handling.

Drawing illustrates method of storing, handling and feeding solution of concentrated brine while avoiding salt accumulations on interior and exterior of equipment. Brine-storage or salt-dissolving tank is filled with salt to a level of a foot or two above the surface of the saturated brine. Salt is kept above the brine at all times, thus avoiding any accumulation by evaporation at this point. Saturated brine is fed by gravity into a brine-measuring tank, being filtered through a layer of graded gravel about 8-in. thick. Amount of brine required for regeneration is determined and then this amount is measured with a draw-down gage. Brine is educted into zeolite units, being diluted in the process. Should salt accumulate at surface of this tank, addition of a small amount of water will remove it without appreciably affecting concentration.

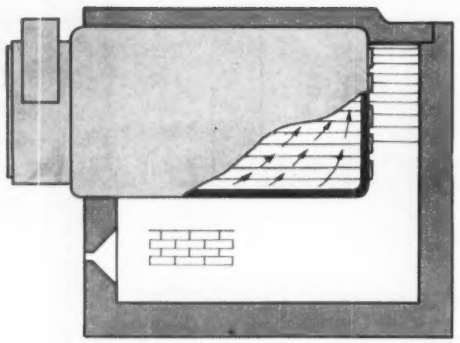
Each tank should be lined with plastic or lacquer for protection against corrosion, but if this coating is too expensive for your budget, use of chemical inhibitor can be very effective. A blend of sodium polyphosphate added to the salt at a rate as low as one lb for every 200 lb of salt has proved satisfactory. There is an extra bonus here, for polyphosphate removes iron from exchanger bed in addition to providing protective film on all metal surfaces in the brine system.

Another refinement would be fitting plywood covers on tanks—one over raw salt to keep dust and other contaminants out, another over brine-measuring tank to reduce evaporation.

C R HEDENSTAD, *Salt Lake City, Utah*

Turn page for new problems ▶

More **plant problems**



The problem

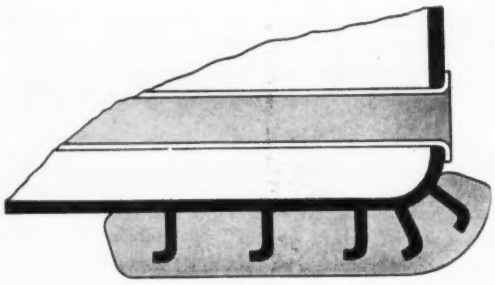
Why are the tubes leaking in our 3-year-old boiler?

We have four horizontal-return-tube boilers used for hot-water heating. Two boilers are only three years old; the others have been in service over nine years.

One of the 3-year-old units suddenly started to leak where the lower pass of tubes enters the rear tube sheet. Rolling them stopped the leak. But about two weeks later they started to leak again. Each time the upper pass remained leaktight.

This boiler has received excellent care. Boiler-water temperature ranges from 160 to 220 F, depending on outside temperature. Raw water was used for initial fill of the system. However, makeup is very slight and there hasn't been any excessive scale deposit, so we don't feel this is causing our trouble. The rear tube sheet somehow must have shifted to create the leak. To date we have not come up with a definite answer to the problem. I'm interested in hearing from anyone who can explain our difficulty.—*DDC*

The solutions



Blame low circulation, high heat transfer

This problem is characteristic of HRT boilers—low water circulation and high rate of heat transfer in the same area cause the leakage. Bottom tubes tend to have lower temperature than tube sheet and low part of shell end.

Incoming cold water makes a combined circulation which leaves a dead corner where the shell and tube sheet have highest rate of heat transfer. Different thicknesses also contribute to increased temperature variation.

Old but effective protections *DDC* can use are refractory lining at end of shell to slow down rate of heat transfer, and drain outlet where the impurities accumulate. *DDC* has a warning! Protect the four boilers now before they all start to leak.

J Boresta, *West Englewood, N. J.*

Install drilled, internal feed pipe

It appears to me that trouble with tubes is caused by a great variation of temperature in feedwater entering the boiler.

I am assuming water comes through drain pipe or enters boiler in one spot, near or against tubes which are giving trouble. In view of this, I suggest that *DDC* install a pipe on feedwater inlet, inside boiler at center, on top of tubes and parallel to them. This pipe should be one ft shorter than inside length of boiler.

Before installing pipe, drill a number of holes $\frac{3}{8}$ in. in dia on one side of pipe only, equal in total cross section to area of the pipe. Holes should be spaced farther apart at inlet end and first hole should be one ft from tube sheet. Plug the pipe end and point up the row of holes.

This arrangement lets feedwater enter in the hottest spot of the boiler with even distribution, thus keeping all tubes and sheets near same temperature. This will stop constant expansion and contraction of the tubes and will, in my opinion, eliminate cause of the trouble.

E E Waters, *Tacoma, Wash.*

Check operation against recommendations

DDC mentions water temperatures, but does not indicate output and fuel type or details of boiler internal construction. Usually, HRT units have low water-circulation rates which are not well suited to rapid firing. These are result of widely fluctuating loads.

For satisfactory operation heat-release rate for this type boiler, generating hot water, should not exceed 150 Btu per sq ft. At higher values greater operating temperatures prevail. The large temperature difference between inside and outside surfaces may cause excessive internal stresses.

Because of the temperature limits associated with HRT boilers, it is necessary to limit solids concentration in the water. Some units have an internal furnace which allows use of feedwater having a large solids concentration. With this design the solids tend to settle in lower part of the boiler and can easily be removed as sludge.

To determine troubles and correct their cause, I suggest that *DDC* adopt the following procedures: (1) Measure water-output rate. (2) Check water inlet and outlet temperatures. (3) From (1) and (2) and knowing heating surface, estimate heat-release rate. Compare with value recommended by the manufacturer. (4) Check temperature of gas leaving boiler and make a flue-gas analysis (Orsat). Incomplete combustion may cause carbon deposits on heat-transfer services. Since rear tube sheet is in a relatively cold location compared to other parts of the furnace, poor heat transfer may result, causing high internal stresses. (5) Take water sample and analyze for solids content. Compare with values recommended by the manufacturer. (6) Inspect the through bolts connecting front and rear tube sheets. Since these components are employed to stabilize the sheets, any component distortion resulting from high thermal stresses will cause the sheets to distort, lead to tube leakage.

H B WAYNE, *Woodhaven, N. Y.*

Watch excessive firing rates

DDC does not give enough information as to size, kind of fuel used, type of burner, or if unit is a packaged boiler. He does not give the location of the return circulating line entering boiler or how it discharges. Judging by data given, his headaches could be caused by an unequal expansion from too quick a startup. Perhaps his automatic oil burner starts, then goes to high fire until pressure or temperature setting is reached. Another possibility is that the return water discharges at or near location of the leaking tubes, due to a partially plugged or broken internal-feed or mixing pipe inside boiler. This would cause unequal temperature changes.

H S GRAHAM, *Concord, Mass.*

Reduce temperature fluctuations

The trouble *DDC* is experiencing most likely comes from unequal expansion. This can be caused by poor circulation (which would be beyond the operator's control), too rapid cooling when washing, improper location of feedwater inlet or draining the boiler when there is still considerable residual heat in furnace setting. Use of low-temperature water to cool the boiler before washing is, of course, never permissible. Another frequent cause of trouble is traces of oil between tube and tube sheet where they are rolled.

H STEIN, *Brandon, Manitoba, Can.*

Your November problems

How can we reduce boiler blowdown?

We operate an oil-fired packaged boiler rated at 23,000 lb per hr at 150 psig. Condensate returns are from a variety of industrial sources and badly contaminated. They differ widely in both quantity and quality. Required heavy chemical feed and resultant high boiler-sludge concentrations produce intermittent blowdown of about 8%. Only 4% would be sufficient to control dissolved solids. Can POWER readers suggest an inexpensive way to control this sludge and reduce blowdown?—*JSV*

What's best way to handle increased compressed-air loads?

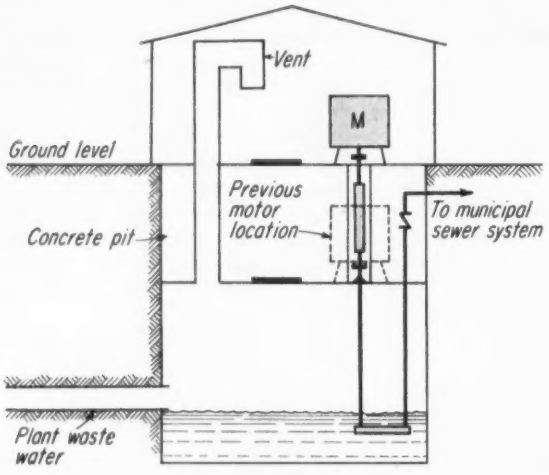
Our plant uses a large amount of compressed air for automatic machine operations, cleaning and process use. The actual plant is over 20 years old, but compressed-air system was enlarged and centralized about five years ago.

Present equipment consists of three 4200-cfm compressors supplying 110-psig air to a plant-distribution system. As process automation and general air demand grew in the past few years, our compressors have been increasingly hard pressed to supply air to new loads tagged on the end of the air-distribution system. We are sometimes caught short for pressure at extreme end of air lines.

Our current problem is how to boost capacity without spending a great deal of money. Because average air load runs about 115,000 cfm, with periodic peaks of 133,000 cfm, we have talked of increasing line capacity to cut pressure drop. This appears to be expensive for the small capacity increase. What do POWER readers suggest?—*LHG*

Sit down right now and answer one or both problems. We'll pay extra for answers with photos or sketches

Timely **practical ideas** to help solve



Raised sump pump solves our flooding problem

Our plant waste-water sewer system starts slightly below the floor level at one end of our plant. It drops 15 feet below the floor level at other end of the plant. At the line's lower end, a pit was constructed to house two sump pumps. These pumps kept the pit dry at a low level. They pumped the water to a higher level so it could flow into the municipal sewer system.

This worked fine during good weather. But every time it rained we'd have a power failure. Then with no power for the pumps the pit would flood over.

After a few motor rewindings due to flooded motors, we decided to put the motors above the ground level. We didn't want to buy longer pumps, as the present ones would do the job if they were kept running.

This problem was solved by installing a channel-iron motor mount just above the ground level and attached to the concrete pit, sketch. The motors of each pump were disconnected at the flexible coupling between pump and motor. By using a plumb line, we located the exposed pump shaft on a channel-iron mount above the ground level. Holes were cut for the motor shaft to run through and for bolting motor to channel iron.

We bought two truck drive shafts with univeral joints at each end from a wrecking yard, and cut them to the right length. We machined hubs for each end to fit pump shaft and motor shaft. These were installed between the pump and motor. Sheet-metal guards were made to enclose the shafts; they are attached at the channel iron and pump base.

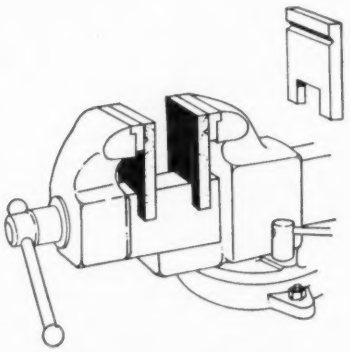
Now the momentary power failures don't affect these pumps, even though pits have been flooded several times since the conversion.

E ZIEGELMANN, *Fullerton, Calif.*

Did you know . . .

Sheet-metal workers and others who use a lead pencil for marking metals often have trouble because pencil's point gets dull quickly. Instead, use an aluminum wire inserted in a mechanical pencil for marking metal. We find this very practical.

N KHO-RAFANAN, *Cebu City, P.I.*

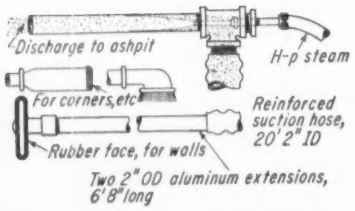


Need heavy-brass vise jaws?

Finished work often has to be held in the bench vise. To protect it against abuse, make a set of heavy brass jaws, sketch. Make them of ½- or ¾-in. brass with a "V" slot on one face of each side—these handle round work. By reversing you'll have a square face. Jaws are shaped to fit the slide. They're heavy and square so they stay in place. They can be made of brass recovered from discarded shunts or bus-bar stock of copper, so they cost very little.

C H WILLEY, *Penacook, N. H.*

Steam jet removes soot by vacuum


Discharge to ashpit
H-p steam
For corners, etc.
Reinforced suction hose, 20' 2" ID
Rubber face, for walls
Two 2" OD aluminum extensions, 6' 8" long

All oil-coal burning plants have a tendency to produce soot and dust in quantity. This stuff forms a layer on motors, handrails, boiler tops, window ledges and even on walls. Attempts at blowing or brushing only scatter it, making still more of a mess.

Years ago I made a steam jet from a 2-in. tee, sketch. I placed a suction hose on the side leg, stuck outlet over the fire and let her go. It had a strong lifting force and was certainly better than brushing or wiping.

Parts shown are standard. Hose should be full size to prevent throttling of suction lift on anything over 12 ft. Sections of aluminum pipe and thimbles should reach almost anywhere you need to clean in your plant.

B RICHARDS, *Toronto, Canada*

your tricky design and maintenance problems

STEVE ELONKA, Associate Editor

Is the chief responsible?

Fifty years ago I was relief operator on the 8 to 12 watch. Rest of day I did repairs in a new building, generated power for elevators and all electrical equipment.

There was one main feed line over the boilers. For emergencies, a connection between feed-pump outlet and blowdown line supplied boilers through the blowdown. But I discovered that no check valve had been placed in this connection. I called this to the chief's attention, but he didn't think we needed one.

A new engineer replaced the 12 to 10 operator. I told him that to feed the boilers through the blowdown he must first close all valves and start the pump, then build up pressure above boilers' working pressure, finally open the blowdown valve.

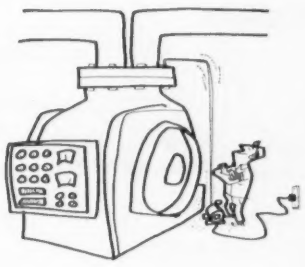
One day a gasket started leaking on the feed line. After preparing to replace it I again told the new operator how to handle the pump. Well, he missed his cue. Boiler pressure backed up through the pump and into the cold-water feed line, which set up a terrific water hammer. Luckily I caught it before any damage resulted. I finally got the water level up so it shut off the low-water alarm whistles.

Then I told the fireman not to open the feed valves but to regulate the blowdown valves. I went aloft to replace the gasket. Just as I had the flanges apart the fireman opened a feed valve to the boiler and I was scalded. Not badly, but enough.

I tied up the chains, replaced the gasket and finally got the boilers back on the main feed line. And the chief thought there was no reason for a check valve in the blowdown line! He failed to see the light before the accident happened — then he discharged the fireman.

That fouled-up hookup was the chief's responsibility. Firing the fireman was harsh and uncalled for. Boiler-room helpers shouldn't have to know all the dangers—dangerous conditions should be prevented by people in charge. What do you say?

E C GRIEF, *Bogota, N.J.*



What would you have done?

We have three 11x9-in. ammonia compressors. They were converted to Freon-12 in 1936. At that time we also replaced the jam type packing in these machines with mechanical seals. But for years our loss of costly Freon was very high. A careful check showed that greatest loss occurred during the shutdown periods between six pm and nine am.

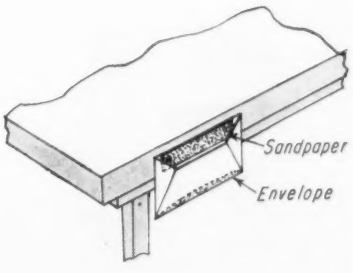
Reason was that condenser and discharge pressures would equalize in the crankcase—that made it tough on the new mechanical seals. We followed the maker's recommendations and refaced, reground, repacked and replaced valves and even the shaft seal from time to time. But that was costly. Management had just about decided it would be cheaper to replace the large central compressors with a newer model, although they hated to make the major investment.

Then I ran across an unused 1-hp refrigeration compressor in our warehouse. I hooked it up to the central compressors so it would operate automatically when the big machines weren't running. All it had to do was keep the large crankcases pumped down to a safe pressure and discharge the Freon to the central receiver.

Since then, leakage has been hardly noticeable. And top management has dismissed expensive plan of replacing the large compressors because there is no need for it. What would *you* have done?

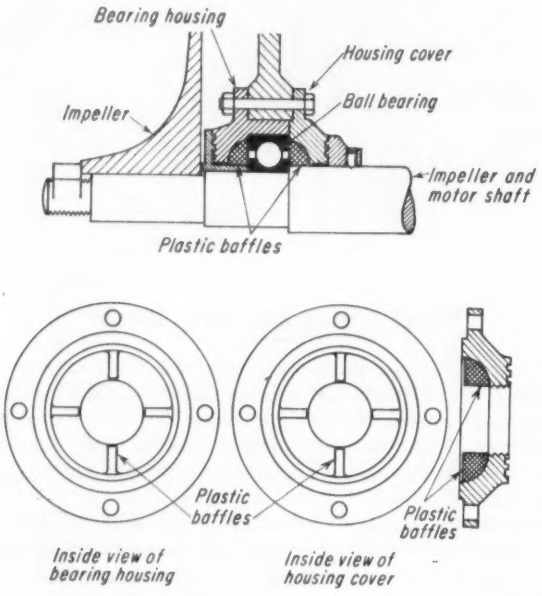
C BACHMANN, *Jamaica, N.Y.*

Make this handy sandpaper lead sharpener



Every good draftsman has his own ideas of how a pencil should be pointed to suit the work he's doing. For your personal sharpener, use a strip of sandpaper or emery cloth inside an envelope. Remove the flap and thumbtack envelope to one edge of drawing board within easy reach, sketch. This is just the thing for pointing the pencil. Envelope serves as a pocket for graphite and wood dust, prevents soiling work or hands.

N KHO-RAFANAN, *Cebu City, P. I.*



Baffles keep ball-bearing grease pack from churning

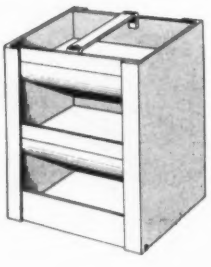
Churning of the grease pack in the inboard bearing housing of our turbo-blower caused a friction temperature rise. Then grease leaked through the seals and messed up the motor.

As sketch shows, we divided the inside of the bearing housing and housing-cover grease space into four compartments by radial baffles molded of plastic-steel compound. That stopped churning of the grease and temperature rise and grease loss. We were surprised at how easy it was to mold the plastic-steel-compound baffles into the housing and cover.

E WITTMAN, *Villas, N.J.*

Carry-all utility box stores cleaning tools

Here's a handy box to store and carry metal and wax polish, rags, ammonia, cleaners, small tools or anything needed by a building-cleaning maintenance man. Just get a metal bin with three shelves and a carrying handle—they're used at home to store vegetables. The three open shelves make it easy to find items at a glance without having to pull everything out of the box.



F LETTINO, *Long Island City, N.Y.*

My biggest boner . . .

It was my first World War II trip to sea on a merchant ship. We were cruising at full speed through submarine-infested waters without escort vessels or a convoy.

Two diesel generators were on the line. I was finishing up my last round on watch, oiling the starboard generator, when a loud WHAM! BANG! startled me. I made a quick turn and started running to my lifeboat station, assuming that any minute the gong to abandon ship would sound. In my haste to get off the catwalk by the intake and exhaust valves I was oiling, I must have dropped my wiping rag and oil can.

As I jumped to the floor plates the lights went out. First one generator stopped, then the other. The low lube-oil pressure, high circulating-water temperature and low-pressure alarms sounded. 'This is IT,' I thought, flashing my light.

I saw the chief run to the port generator. 'He plans to go down with the ship,' I thought. But he started the port generator and the emergency lighting. Then he walked over to the other generator, took out his knife and cut a bunch of rag out of the governor arm linkage. Minutes later we were back to normal speed.

The chief told me what happened. When we loaded the Freon bottles, I hadn't lashed them down, so they fell with the first bad roll. Being near the generators in the machine shop they sounded as though we were hit. And my rag killed one generator. Because the other couldn't take the load, it konked out. The chief told me I'd be a better wiper than an oiler, so wiping I went. I keep cool in a power plant now and make sure I know what happened before pushing the panic button.

TOM MULLIN, *Seattle, Wash.*

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400	West. S.B. Open	CS	900
400	G.E. S.B. Open	IK-17B	900
400	West. S.B. Splash 2800 Volt	CS-89B	720
300	G.E. S.B. Open	IK	1800
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300	G.E. S.B. Open	IK	720
300	G.E. S.B. Open	IK	600
300	West. S.B. Open	CS-1002	600
250	El. Dyn. T.E.F.C.B.B.	KNX	1800
250	G.E. S.B. Open	KT	1800
250	West S.B. Splash	CS-875	1800
250	G.E. S.B. Open 2200 Volt	IK-16	1200
250	G.E. S.B. Open	IK	1200
250	G.E. S.B. Open	IK	900
250	G.E. S.B. Open	IK	720
200	West S.B. Open	CS	1200
200	G.E. S.B. Open	IK-15	1200
200	G.E. S.B. Open	IK-15S	1200
200	G.E. S.B. Open		
200	G.E. S.B. Open 2200 v.	IK	1200
200	G.E. S.B. Open	IK	900
150	LA TEFCBB	JX-114	3600
150	G.E. S.B. Drip	K-6324	1800
150	West. S.S.B. Open	CS-771.1	1800
150	West. S.S.B. Open	CS-761C	1800
150	Al. Chal. B.B. Open AR		1800
150	West. S.B. Open 2200V	CS	1800
150	G.E. S.B. Open	IK	1800
150	G.E. B.B. Open	KT	1200
150	F.M. B.B. Open	H-24A	900
150	G.E. S.B. Open	IK	900
150	Cont T.E.F.C. B.B. New		900
150	G.E. S.B. Open	KT-558	900
150	G.E. S.B. Open	IK	720
125	G.E. TEFCBB	K	3600
125	Burke B.B. Open 440 Volt	N-505	3600
125	Cont. TEFCBB XP	AP-100	1800
125	G.E. S.B. Open	IK	1800
125	West. S.S.B. Open	CS	1800
125	Al. Chal. B.B. Open AR		1800
125	West TEFCBB	CS655	1200
125	G.E. S.B. Open	KT-553	1200
125	G.E. S.B. Open	IK	1200
125	G.E.B.B. Open	K-546	1200
125	F.M. B.B. Open	H	900
125	G.E. S.B. Open	IK	720
125	G.E. S.B. Open	IK	600
100	Howell TEFCBB	R-505	3600
100	Cont. TEFCBB XP	AP-505	1800
100	West. TEFCBB	CS-753	1800
100	G.E. S.B. Open	KT-343	1800
100	G.E. B.B. Open	K-504	1800
100	LA TEFCBB	JX-113	1800
100	West. TEFCBB	CS-770	1200
100	G.E. S.B. Open	KT-347	1200
100	West. SSB Open	CS-607	1200
100	F.M. B.B. Open	H20C	900
100	F.M. B.B. Open	H	720
100	F.M.B.B. Open	H	600
75	Reliance B.B. Splash	505	1200
75	Al. Chal. TEFCBB	ARZ	1200
75	F.M. B.B. Open	H	900
75	F.M. B.B. Open	H	600
60	West. TEFCBB	CS-445	3600
60	G.E. TEFCBB	KF-445	3600
60	L.A. TEFCBB-XP	EX-445	3600
60	L.A. TEFCBB	JX-445	3600
60	West. TEFCBB	CS-445	1800
60	Cont. TEFCBB	NP-504	1800
60	G.E. TEFCBB	K-504	1800
60	West. TEFCBB	CS-505	1800
60	G.E. S.B. Open	K-444	1800
60	West. B.B. Open	CS-444	1800
60	West. S.S.B. Splash	CS-445	1800
60	Wagner TEFCBB	CP-445	1800
60	G.E. B.B. Open	K-444	1800
60	G.E. S.B. Open	KT-333	1800
60	G.E. S.B. Open	K-444	1800

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ELECTRICAL POWER EQUIPMENT

A. C. MOTORS—3 ph. 60 Cy.

SLIP RING

Qu.	HP	Make	Type	Volts	Speed
1	1750	G.E.	M-579B8	4800/2400	1800
1	1500	G.E.	MT-6	6600	1187
1	800	Whse.	CW	550	1776
1	600	Whse.	CW-432D-15	440	1778
1	500	Whse.	CW	550	350
1	300	G.E.	MTP-561	2300	1800
1	250	G.E.	MT-424Y	4000	257
1	250	Cr. Wh.	SIZE-290	2300	350
1	250	A.C.		550	600
1	250	Whse.	CW-1010	2200	435
1	200	G.E.	IM	2200	580
1	200	G.E.	IM	2200	435
2	200	Whse.	CW-890	2300	1775

SQUIRREL CAGE

2	550	Whse.	CS-1115	2300	900
1	500	G.E.	FT-559AY	2300	3600
4	500	Whse	CS-1216	2200	500
3	500	G.E.	KF	2300	3600
2	450	Elliott	3910BB	2300	1200
2	400	Whse.	CS	6600/4000	3565
1	300	Whse.	CS-1002	2300	600
1	200	Whse.	CS-903H	2300	1175/878
1	200	G.E.	KT-557	440	1800
2	200	Whse.	CS-8558	220/440	1750

SYNCHRONOUS

1	7000	G.E.	ATI	2240/6600	600
1	3500	G.E.	TS-6438P	2300/4000	360
2	1750	G.E.	ATI	2300	3600
1	1750	G.E.	TS	2300	900

M-G SETS—3 PH. 60 CY.

Qu.	K.W.	Make	RPM	DC Volts	AC Volts
2	2100/1750	G.E.	514	250/350	2300/4600
1	2000	G.E.	514	660	2300/4600
1	1500	G.E.	720	600	6600/13200
1	1500	G.E.	514	250	6600/13200
1	1500	G.E.	600	600	2300/4150
1	1200	West.	720	600	2300/4160
1	1000	G.E.	900	260	6600
1	500	G.E.	900	250	2300/4600
1	500	G.E.	900	125/250	440
1	350	G.E.	900	125	440/4160
2	300	G.E.	1200	250	2300
1	300	Whse.	1200	600	2300
1	250	G.E.	900	250	220/440
1	240	West.	900	125	220/440
1	200	El. Mby.	1200	250	2300/4600

TURBO GENERATORS

Qu.	KVA	Make	Desc.
1	300	G.E.	175/200# Cond. 480/2300 V.
1	1000	G.E.	150# no Cond 2400 V.
1	4000	G.E.	400# surface condenser 2400/4150 volts.

TRANSFORMERS

Qu.	KVA	Make	Type	PH.	Voltages
3	3333	Whse.	OISC	1	13800x2300
3	1000	G.E.	OISC	1	13800x460
2	750	G.E.	PYR.	1	55/255
2	500	Kuhl.	OISC	1	13200x6600
3	333	G.E.	OISC	1	7200/12470Yx2400/4160Y

FREQUENCY CHANGER SETS

Qu.	KW	Make	Freq.	Voltage
1	5000	G.E.	60/50/60	11000/6600
2	2500	G.E.	25 cy/62.5	2300/2300

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1392 KVA Fairbanks Morse diesel engine generator unit 3 phase 60 cycle 2400 volts 300 RPM
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1250 KVA (2) Worthington supercharged diesel engine generator units 3 phase 60 cycle 2400/600/480 volts 360 RPM
New 1949 — Excellent condition

1050 KVA Nordberg supercharged diesel engine generator unit 3 phase 60 cycle 2400 volts 327 RPM
New 1947 — Excellent condition

The above units are still installed and can be adapted for Dual Fuel operation.

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3000 KW GE CURTIS. CONDENSING. 365# ISP. 200° FS 3/60/2300 VOLTS. NEW 1930. FULL AUXILIARIES. BARGAIN.

15000 KW ALLIS CHALMERS. CONDENSING. 250 OR 425# ISP. 700°. 3/60/13200 VOLTS. 1800 RPM. WHEELER SURFACE CONDENSER. AUXILIARIES. NEW IN 1924. IN SERVICE.

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TRANSFORMERS
1—5000 KVA, Westgh. 2300 V pri—249/100 V Sec. 3 ph, 60 cy, many taps.
3—1000 KVA, A-C, 66,000 V pri—2300 V sec. 1 ph, 60 cy.
1—333 KVA step Voltage Regulator, line volts 460, sec volts 0/64, 3 ph, 60 cy.
SUNDFELT EQUIPMENT COMPANY, INC.
802 E. Anaheim St. Wilmington, Calif.
TE-55684

POWER EQUIPMENT

7500 KW West. Cond. Turbo-Gens. (2) 3 ph., 60 cy., 4160 V, 3600 RPM 400 PSI, 750°, D.C. exciter

1000 KW Worth-Moore Cond Ext Turbine 3/60 245/490V 130-300#IP,10#Ext

700 KW G.M. 12-567 Diesel Units (4) 3 ph., 60 cycle, 480/2400 V

150 KW General Motors Diesel Units 3/60 220/440V 1800 RPM - (3)

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PUMPS

10 MAIN FEED PUMPS

PUMP: Ingersoll-Rand — size 5" — three stage — capacity 500 GPM @ 750# discharge pressure. B.H.P 330 — 5000 RPM. *TURBINE:* Worthington-Moore — design pressure 575#/sq. inch — non-condensing — back pressure 20# — 5000 RPM — 330 B.H.P.

GEARED TURBINE-DRIVEN MAIN FEED BOOSTER PUMPS

PUMP: Mfg. by Buffalo Pump Co. — vertical single stage — capacity 550 GPM — 30# discharge — 8" suction — 5" discharge. *TURBINE:* 1 stage impulse — type Y-W — vertical — design steam pressure 575# — back pressure 20# — 12.5 HP — 5500/1750 RPM — mfg by Terry Steam Turbine Co.

2 MAIN FEED BOOSTER PUMPS

Same as geared turbine driven main feed booster pumps above, but with 14.5 HP 440/3/60 AC Star motor & Ward Leonard control. Across-the-line starter with pushbutton.

8 GEARED TURBINE-DRIVEN VERTICAL CONDENSATE PUMPS

PUMP: Main condensate 2-stage vertical pump — mfg by Buffalo Pump Co. *Capacity:* 375 GPM — 70#/sq. inch discharge pressure — 1150 RPM — 22.5 BHP — 9" suction — 4" discharge. *TURBINE:* Single stage — 575# working pressure — 20#/sq. inch back pressure — 22.5 HP — 5360/1150 RPM — Mfg. by Terry Turbine Co.

2 AUX. FEED BOOSTER PUMPS

PUMP: Vertical — mfg by Buffalo Pump Co. — 200 GPM — 30# discharge pressure. *MOTOR:* 7.36 HP — 1800 RPM — 440/3/60 — Star motor, with control.

BRONZE RECIPROCATING STANDBY FEED PUMPS

11 x 8 x 18 — mfg by M. T. Davidson Co. — vertical simplex — capacity 180 GPM — 800/900# discharge pressure — 575# working pressure.

4 TURBINE-DRIVEN FIRE AND FLUSHING SERVICE PUMPS

PUMP: Worthington — horizontal centrifugal. *Fire Service:* 750 GPM capacity — 150 PSI discharge pressure — 3500 RPM. *TURBINE:* single impulse — type B-20 — mfg by B. F. Sturtevant — design steam pressure 575# per sq. inch non-condensing. Back pressure 15# — B.H.P. 80/90.

3 GEARED TURBINE-DRIVEN MAIN CIRCULATING PUMPS

PUMP: Mfg. by Worthington Pump & Machinery Co. — 28" type — vertical single stage — bronze. *Capacity:* 28,000 GPM — discharge pressure 13.5# — 600 RPM — 267 BHP — 28" suction — 28" discharge — 8.5:1 gear ratio. *TURBINE:* single impulse — vertical type — 575# design steam pressure non-condensing — back pressure 15#/sq. inch. RPM 5100 pinion — 600 gear. Reduction gear ratio 8.5:1 — 267 BHP — mfg by B. F. Sturtevant.

3 MOTOR DRIVEN MAIN CONDENSATE PUMPS

Mfg. by Buffalo Pump Co. — vertical 2-stage — 375 GPM — 70#/sq. inch discharge pressure — 1150 RPM. *Motor Data:* 25 HP — 440/3/60 — 1150 RPM — Star Electric Motor Co. — with across-the-line starter, with pushbutton station — mfg by Ward Leonard.

8 GEARED TURBINE-DRIVEN MAIN LUBE OIL PUMPS

Mfg. by Northern Pump Co. *PUMP:* Vertical rotary type — 750 GPM — 55#/sq. inch discharge pressure — 263 RPM — 35 BHP — oil viscosity 130 to 500 S.S.U. — 7" suction — 6" discharge. *TURBINE:* Single stage — 575# design pressure non-condensing — exhaust pressure 15# — 35 BHP — 26.39:1 gear ratio — 6940 RPM.

4 TURBINE-DRIVEN GEARED FUEL OIL BOOSTER PUMPS

Mfg. by Northern Pump Co. — vertical rotary — 300 GPM — 150# discharge pressure — 282 RPM — 47.3 BHP — Oil viscosity 70-700 S.S.U. — 7" suction — 5" discharge. *DRIVE:* single stage impulse — 575# non-condensing — 15#/sq. inch discharge pressure.

6 FUEL OIL SERVICE PUMPS

Mfg. by Northern Pump Co. — vertical rotary — 85 GPM — 350# discharge pressure — 560 RPM — 27.4 BHP. *TURBINE:* 1 stage — 575# non-condensing — exhaust pressure 15# — mfg. by Northern.

VALVES

THESE ARE JUST A FEW OF THE MANY VALVES OFFERED. ALL TYPES ARE AVAILABLE INCLUDING REDUCING—SENTINEL—RELIEF—MICROMETER—PRESSURE REGULATING—ANGLE, ETC! STEEL—600# SERVICE—SEND US YOUR REQUIREMENTS FOR QUOTATIONS

LESLIE 2" GOVERNOR VALVES

Type C.P. — class A — capacity 7640#/hr. — 575# steam pressure — 750# discharge pressure.

MOTOR OPERATED GATE VALVES

Low Pressure — comp. geared — 38" — mfg by Chapman Valve Co. *MOTOR DATA:* H.P. 18 ft. lbs. running torque — 45 ft. lbs. max. starting torque — 440 volts 900 RPM 3 phase 60 cycle. Type: Submersible Valve Brake — Motor: Star Electric Co.
Also available, same as listed, but 36", and 28" inch as listed, but with smaller motor.

MISCELLANEOUS

18 WIDE-RANGE FORCED DRAFT TURBINE-DRIVEN BLOWERS

9 K.H. — 9 L.H. — mfg by B. F. Sturtevant — propeller fan type — capacity 29,500 CFM/5540 RPM/250 BHP — 8250# steam/hr. — and, 9,000 CFM/1985 RPM/9 BHP — 690# steam/hr. — 7 blades — static: max 35" water — normal 21.5" water. Driven by Sturtevant turbine type VC-7 — non-condensing — single stage — 250 HP — 575# steam pressure — 15# PSIG exhaust pressure.

1250 K.W. WESTINGHOUSE TURBO-GENERATORS

(4) — Westinghouse—440/3/60 — 850° — 540 lbs. working pressure. Complete with condensers, circulating pumps, etc.

LUBE OIL COOLERS

4 — mfg by Westinghouse. 1600 sq. ft. cooling surface — cylindrical straight-tube horizontal type. Oil capacity 590 GPM — water capacity 1500 GPM — temp. oil inlet 150°F — outlet 120°F — temp. water inlet — 85°F — outlet 90°F. Number of ⅝" tubes 816 — Wall 0.049 TK — Cupro-Nickel.

MAIN CONDENSERS

Mfg. by Foster-Wheeler — 23,500 sq. ft. cooling surface — 40,500 GPM circulating water — total tubes 8,976, of cupro-nickel, as follows: (550) each ⅝" x 0.066 and (8416) each ⅝" x 0.049. Monel water boxes.

BOILERS

7 B&W EXPRESS TYPE

Design pressure 634# — operating pressure 565# — temp. 850°F. Oil fired — separately fired superheaters. *Capacity:* 210,000 lb. steam/hr. Ideal for testing where large quantities of steam are required, giving excellent control from separately fired superheaters.

3 GLAND EXHAUST CONDENSERS

Foster-Wheeler — total capacity lbs./hr.: 1200 lbs. steam and 350 lbs. air — 155 sq. ft. — 4" ejector.

LARGE DEAERATING FEED HEATERS

Monel construction — spray type — capacity 480,000 lbs./hr. — vent condenser — single pass — heating surface 174 sq. ft. — all Monel construction.

GE HIGH AND LOW PRESSURE MAIN PROPELLING TURBINES

WILL SELL SEPARATELY FOR TESTING, WIND TUNNEL OR SIMILAR WORK. *(2) High pressure* — 24,400 HP — 12 impulse stages — 4909 RPM — working pressure 540# — 825°F. *(2) Low Pressure:* 28,600 HP — 3913 RPM — working pressure 49# steam — 424°F — 2-6 stages of impulse.

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A. C. MOTORS—60 CYCLE

HP	Mfr.	Type	Volts	Speed
800	Whse. (2)	Sq. Cage	2300	1800
750	G.E.	Slipring	2300	514
700	Whse.	Slipring	2300/4000	1200
600	G.E.	Synch.	480	900
600	Elliott (2)	Sq. Cage	2300	900
500	Allis Ch.	Slipring	2300/440	600
400	G.E.	Sq. Cage	440	1200
400	Whse.	Sq. Cage	2200	1800
400	Marathon (2)	Sq. Cage	2200	3600
400	G.E.	Slipring	2300	514
400	El. Machy.	Synch.	2300/4000	400
350	Br. Boveri b.b.	Sq. Cage	4800/480	720
350	G.E.	Sq. Cage	2200	1800
350	G.E.	Slipring	440	1200
350	Allis Ch.	Slipring	2200/4000	600
350	G.E.	Slipring	220/440	900
300	Whse.	Synch.	440	1200
300	G.E.	Slipring	220/440	514
250	G.E.	Sq. Cage	2200/440	1200
250	G.E.	Sq. Cage	2200/440	450
250	Gen. Elec.	Sq. Cage	440	3600
250	G.E. TEFC	Sq. Cage	440	1200
250	Whse.	Sq. Cage	2300/440	600
250	Whse. (4)	Slipring	2300/440	600
200	G.E. b.b.	Sq. Cage	220/440	720
200	G.E.	Slipring	220/440	450
200	G.E.	Slipring	440	600
200	G.E.	Slipring	2200	900
200	Reliance b.b.	Sq. Cage	220/440	1800
200	Allis Ch.	Slipring	2200/440	720
200	Whse.	Sq. Cage	2200/440	900
150	Whse. XP	Sq. Cage	440	3600
150	G.E. (4)	Slipring	2200/440	600
150	Cr. Wheeler	Sq. Cage	0/440	450
150	G.E. (2)	Sq. Cage	2300/440	1800
150	Whse.	Slipring	220/440	1200
150	G.E.	Sq. Cage	2300	900
125	A.C. TEFC	Sq. Cage	220/440	1800
125	El. Machy. (2)	Synch.	220/440	400
125	G.E. TEFC	Sq. Cage	2200	3600
125	Al. Ch. TEFC	Sq. Cage	220/440	600
100	Whse. TEFC	Sq. Cage	220/440	1200
75	G.E. b.b. (8)	Sq. Cage	220/440	1200

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
200	Gen. Elec.	RC	250	1450
75	Allis Ch. b.b.	EB-146L	125	1500
75	G.E. b.b.	CD	250	1750
60	Ideal	D	125	1150
60	G.E. b.b.	CD	600	1750
40	Reliance b.b.	230-T	250	1200

D. C. MOTORS

HP	Mfr.	Type	Volts	Speed
250	Cr. Wh.	161-H	230	1150
200	G.E. (2)	RC-3½	230	1150
200	Whse. b.b.	SK	250	287/575
150	Rel. TEFC b.b.	2550-F	230	850
150	Whse.	SK-210	230	320/1000
125	G.E.	CD-173	230	575/1150
100	Delco b.b.	late	120/240	1200
100	Elliott b.b. T.E.	JH-FS	230	1150
80	Whse. dyn. b.b.	SK-123L	250	1800/5000
75	Whse. (3)	SK-160	230	550/1150
75/100	Whse.	SK-191	230	300/900
60	G.E. TEFC b.b.	CD-135	230	1150
50	G.E. drip b.b.	CD-1445	230	300/1200
50	G.E.	RF-16	230	250/1000
30	Whse. b.b.	SK-133	230	400/1600
25	Whse. (2)	SK-153	230	300/1200

MOTOR-GENERATOR SETS

KW	Mfr.	Input V	Output V
600	Allis Ch.	440 AC	250 DC
300	Whse. (2)	2200/440 AC	250 DC
200	Gen. Elec.*	220/440 AC	125 DC
125	Gen. Elec.*	2300/4000 AC	250 DC
125	Whse.	220/440 AC	250 DC
100	Delco b.b.	220/440 AC	120/240 DC
75	G.E. b.b.	220/440 AC	250 DC
75	G.E.	220/440 AC	125 DC
60	Allis Ch.	220/440 AC	250 DC
50	G.E. b.b. (3)	220/440 AC	250 DC
35	Reliance b.b.	230/440 AC	250 DC

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TRANSFORMERS—60 CYCLE

Qu	KVA	Make	Type	Phase	Voltages
2	3000	Moloney	TCR	3	7200/6600-4160/2400
2	750	G.E.	K	1	4800-120/240
1	300	Penna.	(Askarel)	3	12470Y/7200-240
2	250	G.E.	H Pyranol	1	4800/2820Y/120/240
3	250	West.		1	2300/4600-230/460
3	200	G.E.	HSW2F	1	2400/4160-240/480
3	200	Amer.	CC	1	4160/7200-240/480
6	100	West.	Hypersil		2400/4160-120/240
3	75	G.E.	KF	1	2400/4160-120/240
3	50	G.E.	H	1	2400/4160-240/120
1	50	Amer.	Abestol	3	4160-120/208Y
4	25	West.	Hypersil	1	2400/4160-120/240

MOTOR GENERATOR SETS

Qu	KW	Make	Speed	DC	AC
1	75	EM	1200	250	Syn. 220V.
1	75	G.E.	1200	125	2300/4160 Syn.
1	100	West.	1200	250	2300/4160Y Syn.
1	175	West.	1200	125	4150 Syn.
1	300	G.E.	1200	250	2300/4160Y SR
1	300	G.E.	1200	250	440 Syn.
1	1000	West.	720	600	2300/4160Y

ENGINE GENERATOR SETS

1—Hercules Gas HXE 62.5 KVA Westghe 3/60/480—1200
1—Wisconsin Gas (Air) PD-99 7.5 KVA Master 1 or 3/120—2200 r.p.m.

SLIP RING MOTORS

Qu	HP	Make	Speed	Type	Volts
2	40	West.	600	CW	220/440
1	60	G.E.	1800	MT	220
1	60	G.E.	850	MT 546	440
1	75	G.E.	600	IM	440
1	100	West.	1800	T.E.F.C. B.B.	220
3	150	Allis-Ch.	1800	AY-RW	2300
1	200	West.	514	CW	440
1	250	West.	600	CW	440
1	350	West.	1800	CW	2300
1	450	West.	1800	CW-4-30-9,	220 or 440
1	500	G.E.	450	MT	2300
1	500	G.E.	1200	MS68Z	2300/4160Y

D. C. MOTORS—230 VOLTS

Qu	HP	Make	Speed	Type
1	350	G.E.	1200	Pedestal
1	92	West.	435/1000	SK 113
1	30	G.E.	1750	173 FR
1	30	West.	690/1400	SK-4G1543

SQUIRREL CAGE MOTORS, 3 PHASE, 60 CYC.

1—300 HP, 1200, Allis. Chalmers, 2300/4160Y
1—275 HP, 1130 RPM G.E. Type KT 559BS 2200V
2—200 HP, 1790 RPM, G.E. Elec. KF, TEFC, 2300V
1—100 HP, 1775 RPM G.E. KTP-543 3Ø 60-440V.

MOTORS—SYNCHRONOUS—3 ph. 60 cy.

100 HP 900 RPM G.E. Fom BL 2200 V.
125 HP 600 RPM G.E. Type TS 2200 V.
125 HP 900 RPM G.E. Type TS 4800 V.
150 HP 3600 RPM G.E. type TS Fr. 956Y 2200 V.
150 HP 1800 RPM G.E. Type TS 220 V.
300 HP 720 RPM Elec. Machinery t.e.f.c. 2300 V.
325 HP 900 RPM West—2300 V.
400 HP 450 RPM Westinghouse Type HR 440 V.

GUARANTEED "REBUILT" POWER EQUIPMENT

SQUIRREL CAGE MOTORS

3 phase, 60 cycle, 220 or 440 volts (*2300 volts or higher)

H.P.	MAKE	TYPE	SPEED
1250	*Al.-Ch.	ANX	3600
600	West.	CS	720
600	*G.E.	K-83455	1200
800	*G.E.	K-83455	1200
500	*G.E.	I-13-E	900
350	*G.E.	KT-559-A	1800
300	*G.E.	K6344	1200
250	*W (TE)	CS-81205	1800
250	*G.E.	KT-509-S	1800
250	*West.	CS-875-S	1800
250	Brook	RS26	1200
200	*G.E.	FT-549	3600
200	*G.E.	I-K-13B	1800
200	*G.E.	CSP-581-S	1800
200	West.	RS-27	1200
200	Brook	CS-930-A	900
200	*West.	KT-564-S	720
200	G.E.	AM-37-G	720
200	*Al.-Ch.	CS-1010	600
200	*West.	ARW-631	600
200	Al.-Ch.	SC-140	3600
150	Cr-Wh.	AN 30-F	1200
150	Al.-Ch.	CSP-5815	1200
150	West.		

M.G. SETS

Kilowatt	Make	Volts AC	Volts DC
1000	West.	4000	250
750	G.E.	4160	275
500	West.	440	250
400	Al. Ch.	2300	240
300	West.	2300	250
200	G.E.	2300	275
200	Rdwy	2300	250
150	Al. Ch.	2300	275
150	West.	2300	250
125	Cr. Wh.	4160	125
125	G.E.	2300	250
100	G.E.	2300	250
100	Al. Ch.	2300	250
60	G.E.	220/440	250
40	G.E.	220/440	250

HUNDREDS OF BARGAINS
in
MOTORS, GENERATORS, CONTROL, HOISTS, COMPRESSORS, ETC.

SLIP RING MOTORS

3 phase, 60 cycle, 220 or 440 volts (*2300 volts or higher)

H.P.	MAKE	TYPE	SPEED
2500	*G.E.	MT (Mill Type)	257
1100	*G.E.	MT	720
1000	*G.E.	M-575-S	1200
1000	*West.	CW	450
600	*G.E.	M-8343-S	1800
500	G.E.	M-8345	1200
400	*G.E.	MTP-585	1200
350	*Al.-Ch.	ARYW	1800
300	Cr-Wh.	SR-70-R	1800
250	Al.-Ch.	ARY-626	1800
250	*G.E.	I-M-17A	720
200	G.E.	I-M-16	600
200	*West.	CW1950A	514
150	Cr-Wh.	SR-50R	1800
150	G.E.	I-M-15A	600
125	G.E.	I-M-15A	900
100	G.E.	I-E-13A	1800
100	G.E.	MT558	720
100	G.E.	I-M-15A	425
75	West.	CW-770	1200

WRITE FOR CURRENT STOCK LIST

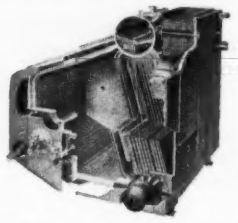
CHICAGO Electric Co.

ALL TYPES OF EQUIPMENT IN STOCK

1320 W. CERMAK RD. • CHICAGO 8, ILL. • PHONE: CANAL 6-3900

FOR POWER
J.L. HEMPHILL & CO.
1603 54th STREET, NORTH BERGEN, N. J.
PHONE NEW YORK—LONGACRE 5-7227
PHONE NEW JERSEY—UNION 1-2600

BOILERS NEW UNASSEMBLED



# Steam/hr.	Key	PSI	Temp.
122,500	DF	565	850
121,650	DF	565	850
60,000	SF	435	750
74,000	H	280	500
55,000	A	240	—

DF Double Furnace, SF Single Furnace (illustrated), bent water tube boilers w/economizers and superheaters, B & W's and Foster Wheelers.

H Header type, straight tube, B & W.

A 3 drum, single furnace, Wickes.

Pelnik-Loconti Industrial Supply, Inc.

315 Oriskany St., Yorkville, N.Y.
Utica, N. Y. Ph. RE 6-4621, RE 2-4513

BOILER

1—Keeler 200 HP, 160 psi, water-tube w/ stokers

COAL PULVERIZERS

1—Babcock & Wilcox #32B, 75 HP
1—Raymond 6-roll mill, 66" dia., 200 HP
3—Robinson #13 Sawtooth Crushers, 15 HP
(4) Fairbanks-Morse 1800 HP Diesel Engines, with 1100 KW DC generators & 1300 HP motors.

WRITE FOR DETAILS

PERRY EQUIPMENT CORP.
1422 N. 6th St., Philadelphia 22, Pa.
Phone: POplar 3-3505

FOR SALE

14 NEW TURBINES

4 horizontal, 10 vertical, Westinghouse Driving forced draft blowers—capacities ranging from 39000 to 56000 CFM and 16" to 24" pressure. Steam pressures 360 to 575#, back pressure 10#.
Will sell turbines separately if desired.
Price reasonable.
Also—1—250 KW GE turbo generator unit, 3 phase, 60 cycle, 440 volts. Used one year.

G. M. De ROSE
2457 WOODWARD AVE.
706 DONOVAN BLDG.
DETROIT 1, MICH.

COMPLETE MODERN 400 LB. POWER PLANT

3750 KVA Elliott Turbine Generator—563 H.P. Wickes Boiler 475 PSIG W.P.

Turbine is 440 PSIG 750° FTT Generator is 3/60/2400/4160. Surface Condenser and all auxiliaries.

This plant is complete in all respects and can be inspected as originally installed. Photographs, prints and specifications available

Other turbine Generators

1-1500 KW Westinghouse	525# 750° Non-Cond. 150# BP 2400V
1-2000 KW GE	600# 750° Non-Cond. 150# BP 4160V
2-3000 KW GE	600# 750° Non-Cond. 150# BP 2400/4160V
1-2500 KW Allis Chalmers	400# Autext 150° Non-Cond. 30# 480V
1-2500 KW Westinghouse	125# Non-Cond. 10# BP 2300V
1-2500 KW GE	400# 750° Autext 25# Condensing 600V
1-5000 KW GE	600# 750 Condensing 2300/4160
1-7500 KW Westinghouse	400# 750 Condensing 4160V

Cable Address: CHASWEAVER

CHARLES WEAVER, INC.
19701 JAMES COUZENS HIGHWAY
DETROIT 35, MICHIGAN

Telephone: BRoadway 3-1900

USED MACHINERY FOR SALE

One used D & H floor type, horizontal boring, milling and drilling machine. 6½" bar, horizontal travel—24 ft., vertical—12 ft., bar travel—62 inches. Power R.T. to head and column.

One #5 Gisholt Universal Turret Lathe, automatic chuck and bar feed. Threading attachments, pump, etc.

Three #3 Gisholt Universal Turret Lathes, automatic chuck and bar feeds (one has extended bed—24" extra length), pump, etc.

One #1-L Gisholt Universal Saddle type Turret Lathe, automatic chuck and bar feed. Taper and threading attachments to cross slide, pump, etc.

One Baker, Model #25 Keyseater—S.P.D.

One #2-20 Kent-Owens Vertical Mill # 40 taper in spindle pump and one set of change gears.

One Hossfield power bender with Vickers hydraulic system and some dies.

One 10-ton Northern Engineering Works Crane complete with controls for 230 volt DC operation. Span: 66'6"; Lift: 25'. Clearance required (top of rail to lowest point of obstruction) 70".

Address replies to:
C. H. WHEELER MFG. CO.
19th & Lehigh Avenue, Philadelphia 32, Pa.
Attn: Mr. Albert J. Collet

BOILERS

BOUGHT	*SOLD*	*RENTED*

2—50,000 lbs. hr. Combustion Engineering 250 lbs. press—1950
2—600 H.P. B & W Sectional Steel Headers—200 lb. press
1—300 H.P.—15 lb. press Superior Package
1—200 H.P.—15 lb. press Cyclotherm
1—125 H.P. Dowtherm — Cleaver — Brooks
Cyclotherms 15- 30- 50- 90- 125- 200 H.P.
Cleaver—Brooks—50- 70- 80 H.P.
Waste—Heat Boiler—200 H.P.—250 lbs.

BOILER & EQUIPMENT CO. INC.
743 BEDFORD AVE. BKLYN. 5, N. Y.
ULSTER 5-3588

LIQUIDATION

COMPLETE OIL REFINERY DESTREHAN, LA.

Including

5—Babcock & Wilcox 70,000#/hr Superheated Steam Boilers, integral furnace type, 6188 sq. ft., 450# pressure complete with stacks, blowers, drives and accompanying set of instruments. (New 1952)
1—Ingersoll Rand 2 Stage Reciprocating Compressor, type 2-HHE-2, size 29½ x 17 x 12, 3170 cfm, 125# pressure with GE 600 HP 3/60/2300 V. motor. (New November 1958)
1—Carrier Centrifugal Blower, 3 Stage, 38,300 cfm, disch. press. 32.7#.
1—Carrier Centrifugal Compressor, 6 Stage, 9,370 cfm, disch. press. 124.7#.
1—Carrier Centrifugal Compressor, 3 Stage, 9,750 cfm, disch press. 93#.
190—Centrifugal Pumps, XP motor & turbine drives, up to 9000 gpm.

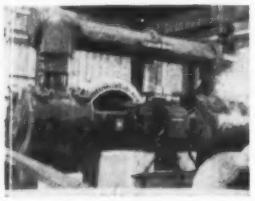
LIST AVAILABLE ON REQUEST
REPRESENTATIVE ON PREMISES

BRILL EQUIPMENT COMPANY
2401 THIRD AVE. NEW YORK 51, N. Y.
Tel.: CYpress 2-5703
SITE OFFICE DESTREHAN, LA. PHONE: NORCO 6571

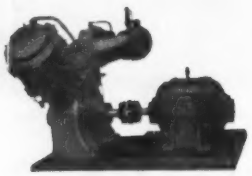
New and Used Equipment Avaiabe for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
Send for new list
EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE Two Rector St., New York 6, N. Y.

THE COMPRESSOR LINE

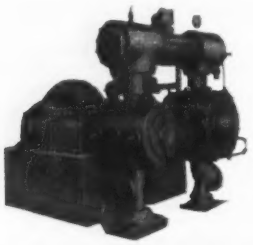
931 CFM Displacement 55# 277 RPM. 17 x 13 Rebuilt Ingersoll-Rand ESE-I, Timken bearing, horizontal, single stage, water-cooled, double acting air compressor equipped with: Free air unloading, Mechanical lubricator, DIRECT CONNECTED TO: 125 HP, 277 RPM unity power factor, 3/60/440 volt synchronous motor with rotor mounted on crankshaft of compressor complete with exciter and automatic starter equipment. Foundation plan.



3798 c.f.m. Displacement 125# INGERSOLL-RAND type 2-HHE-2 two stage air compressor, 29½—17x12, 600 H.P. G.E. sync. motor 3/60/2300. 1957 compressor—ran 86 hours, crane and building available.



691 CFM Displacement 100# 600 RPM. 13½/8 x 7 Flange mounted Chicago-Pneumatic Type "YCM" vertical angle, double acting, heavy duty air compressor equipped with: 3-step control; Mechanical force feed lubricator; Pressure lubrication for running gear; Intercooler with safety valve & gauge; Enclosed frame FLANGE MOUNTED TO: 100 HP General Electric TS 600 RPM unity power factor 3/60/440 volt synchronous motor with CR-7065H5E starter and M.G. set; Aftercooler.



1545 CFM Displacement 80-110# 277 RPM. 21/13 x 14 Used Ingersoll-Rand XRE, two stage, double acting, duplex, water-cooled, heavy duty, horizontal, synchronous motor driven air compressor equipped with: Step control; Mechanical force feed cylinder lubrication; Automatic frame oiling system; Intercooler with safety valve & pressure gauge. DIRECT CONNECTED TO: 250 HP General Electric 277 RPM unity power factor 3/60/220 or 440 volt engine type synchronous motor complete with starter and exciter. Air Receiver.

(CAN BE SEEN RUNNING)

AMERICAN AIR COMPRESSOR CORPORATION

Dell Ave. & 47th St. North Bergen, N. J.
UNion 5-4848

37 Years Dependable Service

SLIP RING MOTORS 3 Ph., 60 Cy.

H.P.	Volts	Make	Speed
500	4000/2300	G.E.	600
450	4000/2300	G.E.	1200
400	4000/2300	Whse.	720
300	4000/2300	G.E.	720
300	2300	G.E.	900
300	440	G.E. (hoist)	600
300	440	Whse.	3600
225	4000/2300	G.E. (hoist)	600
200	2300	G.E.	600
200	2200/440	G.E.	720
150	220/440	Whse.	720
125	2300	G.E.	600

AC GENERATORS or SYN MOTORS, 60 Cy.

H.P.	Volts	Make	Type	R.P.M.
400	2300	G.E.	TS	1800
400	2200/440	G.E.	ATI	720
300	440/220	G.E.	TS	450
300	2200/440	G.E.	TS	1200
200	440	G.E.	TS	600
150	440/220	Whse.	G	1200
125	440/220	Whse.	HR	400

SQUIRREL CAGE MOTORS

500	2200/4000	Elliott	SC	1800
400	2300	G.E.	FT	3600
400	2300/4000	G.E.	K	1200
350	2300/4000	G.E.	SEDP	3600
350	2300/4000	G.E.	K	600
300(2)	2300	G.E.	FT	3600
300	2300/4000	L. Allis.	PS	1800
300	2300/440	G.E.	SEDP	1200
300	2300/4000	Cont'l.	Spl.-Prf.	720
300	2300/400	G.E.	KT	600
250	2300/4000	G.E.	K	720
200	2200	G.E.	KT	1800
200	2200	Cont.	TEFC	3600
150	440	Whse.	X-pf.	3600
150	440/220	Cont'l.	X-pf.	1800
150	440/220	G.E.	TEFC	720
150	2200/440		KT	600
150	2200/440	G.E.	FT	1200
125	2200/440	G.E.	K	600
100(2)	4000/2300	L. Allis.	OX	1200
100	2300	Cont'l.	TEFC	3600
60(2)	440	Cont'l.	X-pf.	1800

CIRCUIT BREAKERS, 3 Pole

4—1600 Amp., DA-50, Whse., 600 V., Air
1—600 Amp., Al. Chal., 15 KV, Outdoor
6— 600 Amp., R. Smith, 7.5 KV, Sol. oper.
1— 400 Amp., R. Smith, 7.5 KV, outdoor, New

D. C. MOTORS

H.P.	Volts	Make	Type	Speed
150	230	El. Dyn.	B/brg.	800
60/75	230	G.E. (new)	CD	500/1500
50/60	230	Rel.	T	600/1800
50	230	G.E.(4)	CD	1150

MOTOR GENERATOR SETS

KW	Make	Input., AC	Motor Type	Output V., DC
300	Whse.	4150/480	Syn.	250/125
125	G.E.	440/220	Sq. Ca.	125
125	G.E.	440	Sq. Ca.	250/125
100	G.E.	2200/440	Syn.	250
75	Cr. Wh.	440/220	Sq. Ca.	240/120
70	El. Dyn.	440	Sq. Ca.	70
65	G. E. B	2200/440	Sq. Ca.	250

TRANSFORMERS 60 Cy.

1—500 kva, Al Ch. 2400/4160Y—600 volts, 3 ph.
3—500 kva. G.E., 13800—2300 V.
3—500 kva, G.E., 13800—240/480 V.
3—333 kva, American, 2400—240/120 V.
1—200 kva, G.E., 2400—120/240 V., Pyr.
3—200 kva, Mol., 13,800—2300 V.
3—200 kva, G.E., 13,800—480 V.
3—200 kva, G.E. 4156—480/240 V.
3—167 kva, Whse., 4156—480 V.
3—150 kva, Al. Ch., 2400—220 V.
3—150 kva, G.E., 13,200—2300 V.
3—100 kva, Whse., 4800/2400-240/480 V., Dry
3—100 kva, G.E. 2400—120/240 V., Pyr.

GASOLINE—ENGINE GENERATOR SETS

2—35 kva, 900 R. 220 V, 3 ph. con. LeRoi, 6 cyl.
only partial listing

STEPHEN HALL & CO.
HARRY J. RICE, Pres.
625 ADAMS ST., HOBOKEN 2, N. J.

SURFACE CONDENSERS

Practically New

4500 Sq. Ft. Westinghouse
3525 Sq. Ft. C. H. Wheeler
Other Sizes

Also New Air Ejectors

CHARLES WEAVER, INC.
19701 James Couzens Hwy.
Detroit 35, Michigan
Phone: BRoadway 3-1900

FOR SALE!!

"As Is — Where Is"

ONE—1450 K.W. 3-Phase, 60 cycle, 2300 volt Steam Power Plant. Complete with boilers and auxiliaries, turbo-generators, condensers, switchboard, spray pond equipment, etc. Will sell as a whole, or in part.

If interested, wire or write for detail description.

TIP H. ALLEN
General Superintendent
Canton Municipal Utilities
Canton, Mississippi

1250 K.W. TURBO GENERATORS

NEW — UNUSED

Mfg. by Westinghouse

GENERATOR:

1250 K.W.—450 volts—3 phase—60 cycle—80% P.F.—1200 R.P.M. with 16 K.W. on a 120 volt D.C. exciter.

TURBINE

540 lbs. per sq. inch gauge with 825° T.T. and one lb. per sq. inch absolute exhaust pressure. It will develop rated capacity with steam conditions of 432 lbs. per sq. inch—825° T.T. and one lb. per sq. inch exhaust pressure. Turbine R.P.M. 6050. The turbine exhausts into an auxiliary condenser.

DIMENSIONS

16'4 5/16" long—60" wide

These units originally built for Battleship Kentucky to highest Naval standards using only prime materials.

THE BOSTON METALS CO.
313 E. Baltimore St., Baltimore 2, Md.
ELIGIN 5-5050 — LEXINGTON 9-1900

DUPLEX UNIT SUBSTATION

General Electric, 4000 KVA, OISC—5000 KVA, FAC. HV: 33,000 V Wye. LV: 2,500 V Delta/4, 330 V Wye. Two outgoing feeders. Automatic tap changing under load. Installed new in 1950.

THREE-PHASE STEP VOLTAGE REGULATOR

General Electric, Type MLT 16/32. 34,500 Volts. 375 KVA. 50.2 Line Amps. 12½% regulation. Excellent condition.

THREE-PHASE POWER TRANSFORMER

Westinghouse, Type SL, Class OA. 1500 KVA. HV: 69,000 V Wye. LV: 12,470 V Delta. Impedance 7.2%. Installed new in 1949.

Above items offered for prompt delivery and subject to any tests you may desire, conducted by authorized service shop, meeting your complete satisfaction.

CONTINENTAL CORPORATION
790 Fulton St., Denver 8, Colorado

DeLaval Boiler Feed Pump—Size LC-315J
Turbine & Pump 4650 RPM—640# steam
15# Back Pressure—675 GPM @ 725# press.
New, Unused with spare parts
2—Elliott Deaerating Feed Tanks—246,500#/hr.
1,000 gal. capy.—New, Unused—Monel Construction

LEWON BROS. 360 Bayshore Blvd., S.F. 24, Calif.
Phone At 2-2726

POWER EQUIPMENT

TRANSFORMERS

1—6000 KVA 3/60/44,000—4160 Substation
1— 750 KVA 3/60/2400/4160 Y—480
3— 333 KVA 1/60/2400/4160 Y—480
3— 250 KVA 1/60/240u/4160 Y—480
3— 75 KVA 4600-115/230 Single phase
2— 50 KVA 440-120/240 Single phase

A. C. MOTORS — 3 ph. 60 Cy.

SQUIRREL CAGE 2300 Volt

Qu.	HP	Make	Type	Speed
2	2000	A.C.	ANW	1750
2	350	A.C.	AZZ TEFC X.P.	3600
1	250	Cont.	NP TEFC X.P.	720
1	200	G.E.	KF TEFC X.P.	3600
1	125	Cont.	NP TEFC X.P.	3600
1	125	G.E.	KF TEFC X.P.	1800
3	100	G.E.	K TEFC X.P.	1800*
1	100	A.C.	AZZ TEFC X.P.	3600

*440 Volt

SLIP RING 440 Volt

1	150	West.	CW	1800
3	75	West.	CW	1800
3	30	West.	CW	1200

BOILERS

3—1296 HP B&W Sectional Steel Headers 275 PSI Gas/Oil Fired

1—75000#/hr 650 PSI 650°F Oil Fired C.E.

1—25000#/hr 450 PSI 738°F Stirling Stoker

1—200 HP 160 PSI Keeler, Stoker Fired

12—NEW UNASSEMBLED B&W, F.W. C.E. with Superheater, Economizer, Soot Blowers, Oil Burners, Steel Encased—Rated:
122,500#/hr, 565 PSI, 850°F
44,500#/hr, 450 PSI, 735°F
35,000#/hr, 285 PSI, 577°F

GENERATOR SETS

11—1250 KVA Natural Gas Engine Sets 3/60/2400/4160 with switch gear
(can be seen running)

1—1875 KVA Condensing 400 PSI 700°F with Surface Condenser 3/60/2300 Turbo Set

1—500 KW Condensing 200 PSI Turbine

1—500 KW G.E. Non Condensing 265 PSI, 0-10# BP Turbo Generator

HEAT & POWER CO. INC.

POWER EQUIP. DIV.

60 East 42nd St., New York 17, N. Y.
310 Thompson Bldg., Tulsa 3, Okla.

BABCOCK & WILCOX COAL PULVERIZERS

2—NEW UNUSED Babcock & Wilcox coal pulverizers, Type E-56, capacity 43,600# coal per hour, each equipped with American Blower Corporation air fan, 15,000 cfm capacity with motor drive.

These are complete coal pulverizer installations with blower air fans, attached and unattached structural parts. Exceptional bargain.

UTILITIES MACHINERY CORPORATION
1965 East Sixth Street, Cleveland 14, O.

1000# PUMPS

2—600 GPM Gould, 8 stage, 2310' head, with 500 HP Westinghouse CSP-583H, 3550 RPM, 440 Volt Squirrel Cage motors and enclosed class 11-600 reduced voltage starters with disconnects.

BELYEA COMPANY, INC.
43 Howell St. Jersey City, 6, N.J.
Tel. Oldfield 3-3334

FOR SALE
IN OPERATING CONDITION

BOILERS

1—20,000#/Hr. Springfield Sectional Header St. Tube Cross Drum for 200# W.P. 100° S.H. with Detroit Dumping Grate Spreader Stoker and all auxiliaries.

2—30,000#/Hr. Babcock & Wilcox Sectional Header Straight Tube Longitudinal Drum for 200# W.P. 100° S.H. with Coppus Gas-Oil Burners and all auxiliaries.

1—60,000#/Hr. Springfield Sectional Header Straight Tube Cross Drum for 250# 100° S.H. with Firite Dumping Grate Spreader Stoker and all auxiliaries.

2—20,000#/Hr. Babcock & Wilcox Sectional Header Straight Tube Longitudinal Drums for 150# Saturated with Detroit Dumping Grate Spreader Stoker and all auxiliaries.

2—30,000#/Hr. Murray Bent Tube 3-Drum Sterling Type for 200# W.P. Saturated with Detroit Dumping Grate Spreader Stokers and all auxiliaries.

AIR COMPRESSORS

1—Steam Driven Ingersoll-Rand 1000 CFM @ 100# uses Steam 175#-500°-5#

1—Steam Driven Ingersoll-Rand XPV-700 CFM @ 100# uses Steam 150#-Sat-5#

1—75 HP Motor Driven Ingersoll-Rand Type 10-375 CFM @ 100#-440 volts-3 phase-60 cycle

1—42" x 12' Compressed Air Tank

GENERATORS

1—300 KW Murray Turbine Condensing OR 5# Exhaust—175#-500° with Westinghouse 470 KVA—440 volt-3 phase-60 cycle Generator, and Ingersoll-Rand Condenser and Pumps.

1—200 KW Skinner 2-cylinder Vertical Steam Engine 150#-Sat.-5# with Electric Machinery 250 KVA—440 volt-3 phase-60 cycle Generator, Switchgear.

MISCELLANEOUS

1—Swartwout Direct Contact 100,000#/Hr. Feedwater Heater & Storage Tank
1—Cochrane Direct Contact 18,000#/Hr. Feedwater Heater
1—Hoppes Direct Contact 50,000#/Hr. Feedwater Heater & Storage Tank
1—Cochrane 5000 GPH Hot Process Softener

1—Worthington 2", Type U, Pump 250 GPM @ 565' Turbine Driven—175#500°-5#
1—Dayton-Dowd 2", Type TU, Pump 250 GPM @ 565' Turbine Driven—175#-500°-5#

1—Worthington 2" Pump—60 GPM @ 350'—25 HP Motor—440 volts-3 Phase-60 cycle
1—Dayton-Dowd Pump—83 GPM @ 397'—Motor Drive—440 volts-3 Phase-60 cycle
1—Ingersoll-Rand Motor Pump—80 GPM @ 500'—440-volts-3 phase-60 cycle
2—Union Steam Pumps 12 x 8 x 12 for Feedwater
2—American Marsh Steam Pumps 10 x 14 x 20 for Condensate

3—Complete Coal Handling Systems with Conveyors
1—United Conveyor Pneumatic Ash Handling System
1—Sawdust Handling System with Fans and Conveyors

Miscellaneous Pipe, Valves, Fittings, Pumps, Etc.

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Orr & Sembowe Packaged Boiler—Model 3H

Rated at 300 hp—will develop 10,350 lb per hr
1500 sq ft of heating surface
15 psig maximum steam working pressure
Constructed to conform to ASME boiler code

Completely equipped to burn #6 fuel oil with all auxiliary controls and equipment. Full modulating system from 20% to 100% of rating for pressure regulation available. Integral boiler feed system complete with pump, motor and controls. 9 kw electric preheater, oil pump, forced draft fan, water level controls, and control cabinet

For further information contact Leon Herzfeld, Esq.

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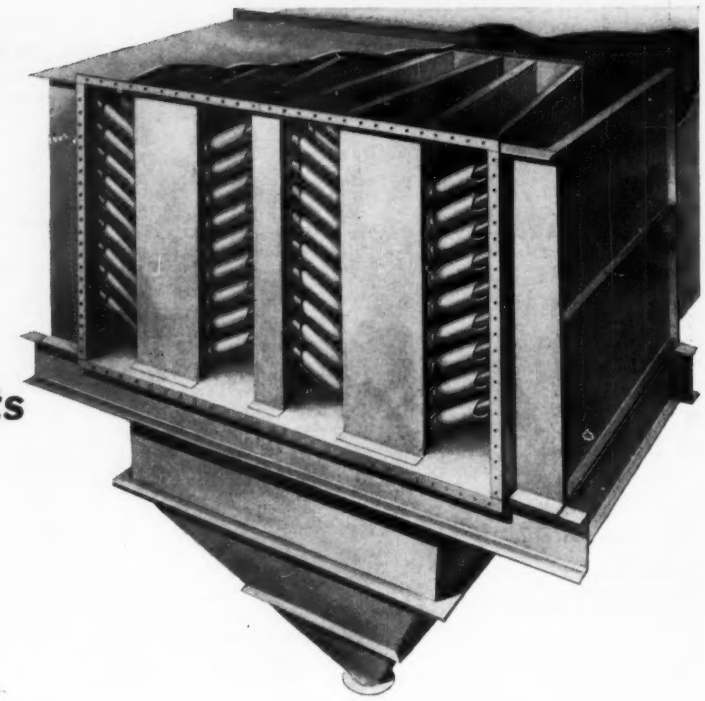
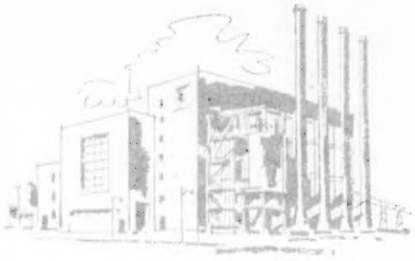
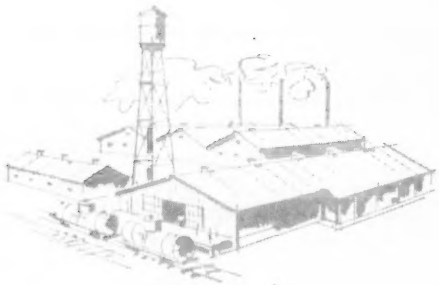
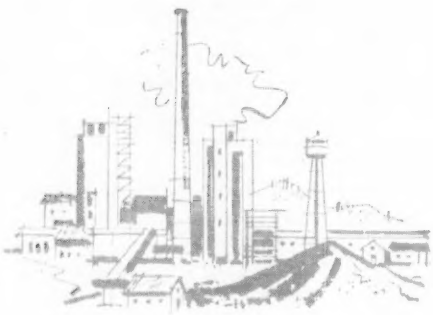
you need a dust collector tailored to your specific requirements









Although mechanical dust-collecting systems seldom approach the efficiency of electrical precipitators, Aerotec's research has developed tubular mechanical collectors that surpass most dust-ordinance and industrial processing requirements.

The selection of a mechanical collector depends on several factors: Efficiency requirements, space availability, abrasive nature of the dust, particle size and, finally, future problems of air pollution control or industrial requirements to be faced by the purchaser.

Through constant research and experience, based on hundreds of installations in many types of industries, Aerotec engineers can evaluate these variables and recommend the unit that will provide optimum service . . . whether it be mechanical, electrical or wet scrubbing equipment.

From multiple-tube installations to large-diameter cyclones, from stainless steel for highly corrosive gases to white iron for abrasive fly ash, Aerotec has designed and manufactured mechanical dust collectors for practically every service.

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FAN-STACKS • BLOWERS • CURTAIN DAMPERS • AIR PREHEATERS • MECHANICAL AND ELECTRICAL DUST COLLECTORS FOR INDUSTRIAL PROCESSES AND FLY ASH • GAS SCRUBBERS FOR CHEMICAL PROCESSES AND NATURAL GAS TRANSMISSION LINES

Fig. 8001 Screwed Ends. Sizes ½" to 2"
Fig. 8002 Socket Welding Ends

A New Lunkenheimer Valve

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This new Lunkenheimer Forged Steel Gate Valve is already building a reputation for rugged service. Completely new in design, it's compactly built for fast installation in the most cramped quarters. Produced with famous Lunkenheimer materials and highly-skilled workmanship, it handles pressures of 800 lbs. at 850°F., and 2000 lbs. at 100°F. easily and safely. Discs are 13 Chrome Stainless Steel, heat treated completely through to 500 Brinell hardness to eliminate chipping or cracking. Rolled-in Seat Rings can't work loose. This newest addition to the world-famous Lunkenheimer line can help solve *your* valve maintenance problems. Call your Lunkenheimer Distributor, or write us for literature. The Lunkenheimer Company, Cincinnati 14, Ohio.

FREE Piping Practice Wall Chart on Valve Selection, Installation, Maintenance

L-1007-4

LUNKENHEIMER QUALITY

LUNKENHEIMER®
THE ONE *Great* NAME IN VALVES

For more facts circle 202 on Reader Service card, p 101

where "specifications" usually fall short

If you plan to choose your next turbine generator by dollars and specifications alone, this message is not for you.

This message is intended for the engineer who looks beyond to the things that really count—the differences that affect turbine-generator performance and life.

We at Worthington believe there are four important such differences: specialization, craftsmanship, reliability and service.

"Specialization" refers to the manufacture of turbine generators in only the size range you are planning to install. At Worthington we specialize in industrial and municipal units. We don't claim to be experts in the larger central-station machines. On the other hand, we have developed a reputation as specialists for these units in our range.

"Craftsmanship" is attention to the details that make the difference in the machine's performance. At Wellsville, N. Y., Worthington turbines are built by men with long-standing records for loyalty and skill. One foreman has been with us for 33 years. One of our machinists recently retired after 40 years' service. Turbine generators have been built in Wellsville for over 50 years.

"Reliability" is the result of *many* things, including craftsmanship, that go into each machine. Reliability has become a creed for our engineering and production personnel. Every Worthington turbine generator is completely assembled and thoroughly tested as a unit before shipment, to best assure reliable and trouble-free operation.

"Service" includes many things besides trouble-shooting. It includes specially trained engineers and mechanics for every possible need, a minimum of "red-tape" in handling the business, speed and flexibility through personal contact, fast parts service, availability of data, training of operating personnel, etc. We believe service-to-you is just as important as the machine. This range of meticulous attention to service detail has resulted in an enviable performance record for Worthington turbine generators.

The next time you choose a turbine generator, remember that there are important differences you should consider. Look at specialization, craftsmanship, reliability and service. If you do, we're convinced you'll choose "Worthington." Worthington Corporation, Wellsville, New York. 48-G

WORTHINGTON

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